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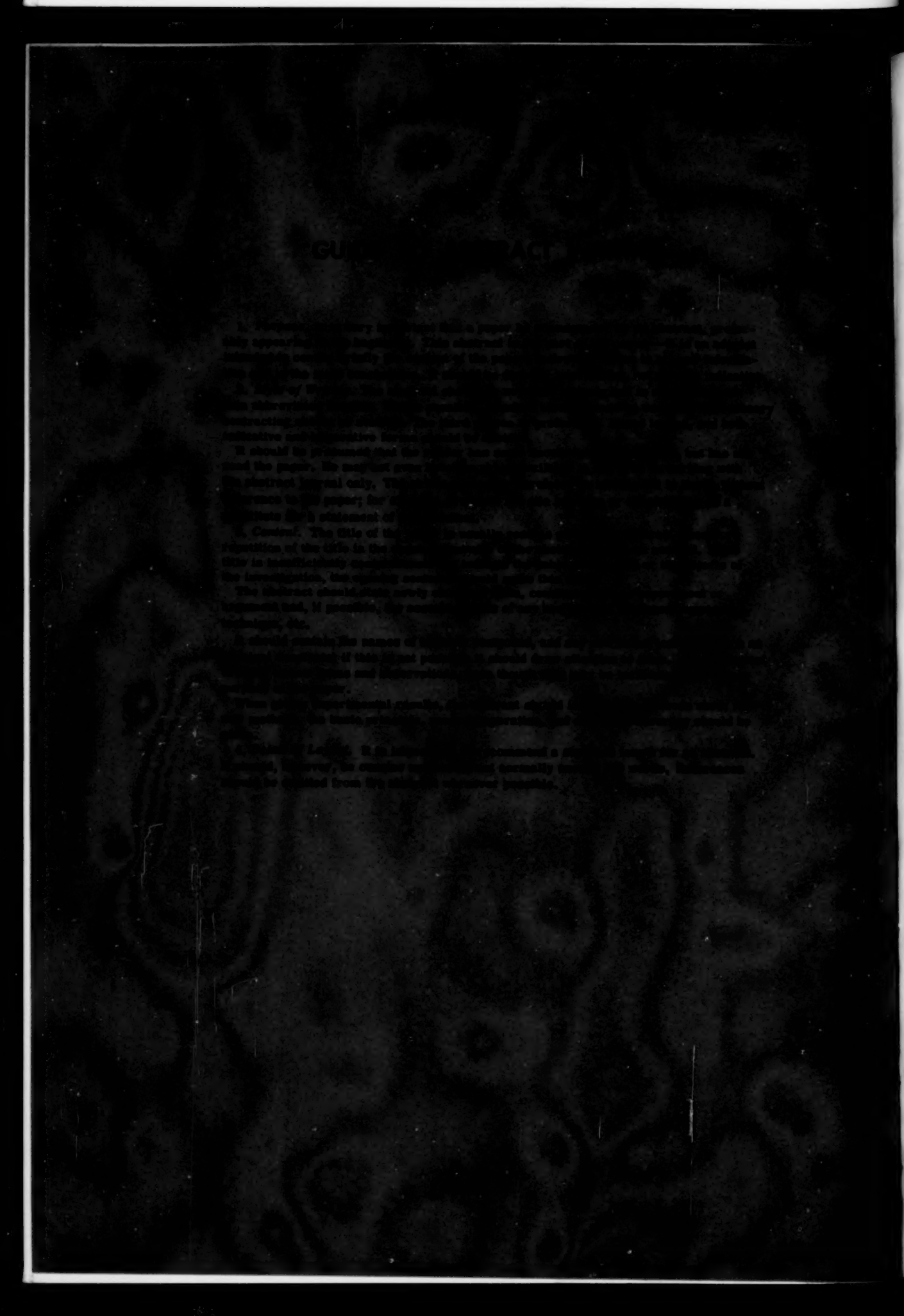

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INTRODUCTION TO

NUCLEAR SCIENCE ABSTRACTS

A Publication of the United States Atomic Energy Commission, Technical Information Service

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March 15-19, 1954

ELEVATED TEMPERATURE CORROSION SYMPOSIUM, Municipal Auditorium, Kansas City, Mo. Sponsored by: National Association of Corrosion Engineers – 10th Annual Conference

Person to Contact: Glenn A. Fitzlen
Ass't. Technical Director
Haynes Stellite Co.
Kokomo, Ind.

June 20-25, 1954

NUCLEAR ENERGY CONFERENCE, University of Michigan, Ann Arbor, Michigan, Sponsored by: American Institute of Chemical Engineers.

Inquiries should be addressed to: Professor Donald Katz, University of Michigan, Department of Engineers, Ann Arbor, Michigan.

REPORTS REFERENCE LIST

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AECD-3559 5942
Hanford Works
THE ANALYTICAL CHEMISTRY OF AMERICIUM AND CURIUM. A. Chetham-Strode, Jr. [nd] Decl. with deletions June 15, 1953. 17p. (AECD-3559; HW-28277)

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National Research Corp.
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National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. SUMMARY OF THERMODYNAMIC DATA. G. R. Findlay. Sept. 16, 1949. Decl. Sept. 22, 1953. 11p. (AECD-3569; NR-16)

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PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT FOR OCTOBER 1949. W. O. DiPietro, G. R. Findlay, and R. A. Stauffer. Nov. 10, 1949. Decl. Sept. 22, 1953. 8p. (AECD-3571; NR-18)

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THE pH OF URANYL SULFATE-URANIUM TRIOXIDE SOLUTIONS. E. Orban. Aug. 14, 1952. Declassified Sept. 8, 1953. 15p. (AECD-3580; MLM-738)

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THE DENSITIES OF URANYL SULFATE SOLUTIONS BETWEEN 20° AND 90°C. J. S. Jegart, J. R. Heiks, and E. Orban. Oct. 10, 1952. Decl. with deletions Sept. 8, 1953. (AECD-3582; MLM-728)

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APPARATUS FOR DETERMINING THE PHYSICAL PROPERTIES OF SOLUTIONS AT ELEVATED TEMPERATURES AND PRESSURES. J. R. Heiks, M. K. Barnett, L. V. Jones, and W. C. McCluggage. Jan. 14, 1953. Decl. Aug. 28, 1953. 31p. (AECD-3584; MLM-799)

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THE TWO GROUP THEORY OF PILES WITH MULTIPLE REFLECTORS. H. L. Garabedian and A. S. Householder. Nov. 11, 1946. Decl. Aug. 28, 1953. 17p. (AECD-3585; MonP-202)

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THE MATERIALS TESTING REACTOR AS AN IRRADIATION FACILITY. John R. Huffman. July 6, 1953. Decl. with Deletions Aug. 19, 1953. 24p. (AECD-3587; IDO-16113)

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Harris Research Labs.
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THE STABILITY OF TETRABUTYLAMMONIUM TETRACHLOROIODIDE. Robert E. Buckles and Jack F. Mills. [1953] 17p. (AECU-2645)

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New York State Coll. for Teachers
CONCENTRATION OF NITROGEN 15 BY CHEMICAL EXCHANGE BETWEEN NO_2 AND NO; SEMI-ANNUAL PROGRESS REPORT FOR PERIOD FROM JUNE 15, 1952 TO JANUARY 15, 1953. W. Spindel, E. H. MacLaren, R. H. Johns, R. P. Lanni, G. W. Reynolds, O. E. Lanford. [nd] 9p. (AECU-2656)

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FORMATION OF 5'-ETHYLTHIOADENOSINE FROM DL-ETHIONINE IN YEAST. F. Schlenk and J. A. Tillotson. [1953] 18p. (AECU-2674)

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STUDIES ON LOW DOSE X-IRRADIATIONS AND ITS EFFECT UPON THE BIOCHEMISTRY AND PATHOLOGY OF THE DOG. PROGRESS REPORT, JUNE 1952 TO MAY 1953. P. H. Phillips. [1953] 8p. (AECU-2680)

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Johns Hopkins Hospital
A HEMORRHAGIC DISORDER OCCURRING IN PATIENTS WITH CONGENITAL HEART DISEASE. Robert C. Hartmann. [nd] 45p. (AECU-2682)

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Oak Ridge Inst. of Nuclear Studies
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ON THE USE OF RADIOACTIVE TRACERS FOR TAGGING

SPECIAL MELTS OF STEEL. David L. Douglas. [1953] 13p. (AECU-2690)

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ELECTRONIC DEVICES FOR NUCLEAR PHYSICS. QUARTERLY REPORT [FOR] APRIL 1953–JULY 1953. G. A. Morton, R. H. Anderson, P. W. Davison, M. W. Green, M. H. Greenblatt, A. L. Solomon, and A. H. Sommer. 22p. (AECU-2691; Quarterly Report 12)

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DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] NOVEMBER AND DECEMBER 1952, AND JANUARY 1953. Austin M. Brues, ed. 149p. (ANL-4948)

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CHRONIC EXTERNAL IRRADIATION, NEUTRON RADIOBIOLOGY, PHYSIOLOGY, HISTOPATHOLOGY, AND RADIOCHEMISTRY. p.11-55 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] NOVEMBER AND DECEMBER 1952, AND JANUARY 1953. Austin M. Brues, ed. 45p. (ANL-4948(p.11-55))

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WELDING AND BRAZING OF BERYLLIUM TO ITSELF AND TO OTHER METALS. R. E. Monroe, D. C. Martin, and C. B. Voldrich. May 28, 1953. 38p. (BMI-836)

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Brookhaven National Lab.
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THE RATES OF DISTRIBUTION OF SODIUM IN NEPHROTIC CHILDREN. James S. Robertson, James L. Gamble, Jr., and Lee E. Farr. [Submitted Aug. 26, 1953]. 39p. (BNL-1549)

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CORROSION TEST ON GLASS COATED STAINLESS STEEL. J. L. English. June 27, 1950. 1p. (CF-50-6-209)

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HEAT CAPACITY OF THE EUTECTIC OF LITHIUM HYDROXIDE AND SODIUM HYDROXIDE. W. D. Powers and G. C. Blalock. May 18, 1953. 2p. (CF-53-5-103)

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CRD-A19-27(pt. 4) 6052
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MATERIALS HANDBOOK. PART 4. PROPERTIES OF TITANIUM. Harry Majors, Jr., R. T. Webster, R. H. Wallace, and G. E. Wendell. Apr. 1953. 60p. (CRD-A19-27(pt. 4))

CRD-A19-27(pt. 7) 6053
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CU-116 6198
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THE POTENTIAL–pH DIAGRAM FOR ALUMINUM. C. Groot and R. M. Peekema. Aug. 17, 1953. 14p. (HW-28556)

IDO-10022 6155
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THE APPLICATION OF TECHNIQUES OF SEQUENTIAL ANALYSIS TO AUDIT PROCEDURES. Miller N. Hudson, Jr. Sept. 25, 1953. 47p. (IDO-10022)

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A PRELIMINARY REPORT ON THE MTR CRYSTAL SPECTROMETER. J. E. Evans. Aug. 19, 1953. 15p. (IDO-16120)

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MANGANESE(II),-(III),-(IV) EQUILIBRIUM IN IODIC ACID. Glenn R. Waterbury and Don S. Martin, Jr. [Jan. 13, 1953] 27p. (ISC-242)

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THE STRUCTURE OF LANTHANUM SULFATE ENNEAHYDRATE. Elton B. Hunt, Jr., R. E. Rundle, and A. J. Stosick. [Jan. 13, 1953] 31p. (ISC-277)

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Ames Lab.
THE SEPARATION OF RARE EARTHS BY ION-EXCHANGE. 8. QUANTITATIVE THEORY OF THE MECHANISM INVOLVED IN ELUTION BY DILUTE CITRATE SOLUTIONS. F. H. Spedding and J. E. Powell. Aug. 6, 1953. 26p. (ISC-385)

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VARIATIONS IN THE DECAY OF PHOSPHORESCENCE WITH FREQUENCY OF APPLIED ELECTRIC FIELD. Keith W. Olson. Sept. 30, 1953. 4p. (ISC-406)

KAPL-951 5997
Knolls Atomic Power Lab.
EVALUATION OF TRANSIENT TEMPERATURES AND STRESSES. R. J. Fritz. July 27, 1953. 51p. (KAPL-951)

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A NOTE ON THE PRECISION CALIBRATION OF VARIABLE FREQUENCY OSCILLATORS. C. Mannal. July 10, 1953. 14p. (KAPL-956)

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Knolls Atomic Power Lab.
HEAT-TREATMENTS OF WELDED STRUCTURES FOR THE RELIEF OF RESIDUAL STRESSES WITH PARTICULAR REFERENCE TO TYPE 347 STAINLESS STEEL WELDMENTS. W. L. Fleischmann. Aug. 17, 1953. 30p. (KAPL-981)

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COLLECTED RADIOCHEMICAL PROCEDURES. Jacob Kleinberg, D. P. Ames, J. W. Barnes, N. A. Bonner, W. H. Burgus, G. A. Cowan, P. B. Elkin, G. P. Ford, J. S. Gilmore, M. A. Melnick, C. O. Minkkinen, H. A. Potratz, R. J. Prestwood, J. E. Sattizahn, T. T. Shull, and C. W. Stanley. Feb. 1, 1953. 197p. (LA-1566)

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Los Alamos Scientific Lab.
DUAL CODING SYSTEM. Stewart I. Schlesinger and Bengt Carlson. July 1953. 25p. (LA-1573)

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SURVEY OF SEVERAL OF THE REACTIONS OCCURRING WHEN LITHIUM AND BERYLLIUM ARE BOMBARDED BY PROTONS AND DEUTERONS OF 30–250 KEV. J. A. Phillips and G. A. Sawyer. Aug. 1953. 14p. (LA-1578)

MLM-595 6137
Mound Lab.
BATH CONTROL, STABILITY OF THE TWIN BRIDGE CALORIMETER, AND THERMAL NOISE. J. R. Parks. Aug. 15, 1951. 24p. (MLM-595)

MLM-810 6004
Mound Lab.
A METAL HIGH-VACUUM MANIFOLD. E. Paige. Feb. 17, 1953. 13p. (MLM-810)

MTA-40 6160
Livermore Research Lab., Calif. Research and Development Co.
COUNTING EFFICIENCIES FOR SODIUM IODIDE CRYSTALS. P. W. McLaughlin and G. D. O'Kelley. Issued Sept. 1953. 22p. (MTA-40)

NAA-SR-254 6056
North American Aviation, Inc.
THE INFLUENCE OF COLD WORK AND RADIATION DAMAGE ON THE DEBYE TEMPERATURE OF COPPER. D. B. Bowen and G. W. Rodeback. Issued Sept. 1, 1953. 17p. (NAA-SR-254)

NYO-3165 5929
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THE THERMAL DECOMPOSITION OF COPPER(II) FLUORIDE DIHYDRATE. H. M. Haendler and C. M. Wheeler, Jr. Sept. 23, 1953. 10p. (NYO-3165)

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Syracuse Univ.
COPRECIPITATION OF MANGANESE(II) ON BASIC STANNIC SULFATE PRECIPITATED FROM HOMOGENEOUS SOLUTION. Louis Gordon, Harry Teicher, and B. P. Burtt. Aug. 15, 1953. 30p. (NYO-3192)

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Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
REARRANGEMENT IN THE REACTION OF CHLOROBENZENE-1-C^{14} WITH POTASSIUM AMIDE. John D. Roberts, Howard E. Simmons, Jr., L. A. Carlsmith, and C. Wheaton Vaughan. [1953] 4p. (NYO-3592)

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BIS-INDENYL DERIVATIVES OF IRON AND COBALT. P. L. Pauson and G. Wilkinson. Aug. 10, 1953. 10p. (NYO-6132)

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ON BIS-CYCLOPENTADIENYL COMPOUNDS OF THE TRANSITIONAL ELEMENTS. F. A. Cotton, W. E. Moffitt, P. L. Pauson, and G. Wilkinson. Aug. 28, 1953. 50p. (NYO-6133)

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STUDIES ON THE NUCLEAR CHEMISTRY OF TIN. C. M. Nelson, B. H. Ketelle, and George E. Boyd. Issued Nov. 10, 1950. 51p. (ORNL-828)

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SCALING OF COLUMBIUM IN AIR. H. Inouye. Issued Sept. 24, 1953. 20p. (ORNL-1565)

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PROGRESS REPORT FOR JUNE 15 TO DECEMBER 15, 1952. PART 1. FRACTURE PATTERN OF THE ZUNI UPLIFT. Arthur K. Gilkey. PART 2. FRACTURE STUDIES OF THE LUCERO UPLIFT. Robert W. Duschatko. Jan. 1953. 26p. (RME-3024)

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RELATION OF SEDIMENTARY FEATURES OF THE SALT WASH SANDSTONE TO TECTONIC ELEMENTS AND URANIUM MINERALIZATION. PROGRESS REPORT, APRIL 1, 1953 TO SEPTEMBER 1, 1953. William Lee Stokes. Sept. 12, 1953. 5p. (RME-3058)

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URANIUM POSSIBILITIES IN THE PHILIPPINE ISLANDS. Edward K. Judd, Helen E. DeSanctis, and Jean C. Brown. Issued July 1953. 31p. (RME-4014)

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UCRL-2244 6270
Radiation Lab., Univ. of Calif., Berkeley
COMPLEX ALPHA SPECTRA OF RADIOTHORIUM (Th^{228}) AND THORIUM-X (Ra^{224}). Frank Asaro, Frank Stephens, Jr., and I. Perlman. June 12, 1953. 24p. (UCRL-2244)

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ELECTRON LOADING AND HIGH VOLTAGE SPARKING OF METALS IN VACUUM. Harry G. Heard. June 29, 1953. 32p. (UCRL-2252)

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Radiation Lab., Univ. of Calif., Berkeley
A NOTE ON THE GREEN'S FUNCTION METHOD. Maurice Neuman. July 16, 1953. 12p. (UCRL-2280)

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Radiation Lab., Univ. of Calif., Berkeley
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SEPARATION OF IRON AND COBALT ON SYNTHETIC RESIN. Harold L. Helwig, James K. Ashikawa, Hugh Clokie, and Elmer R. Smith. Aug. 5, 1953. 6p. (UCRL-2296)

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THE DEPENDENCE OF NEGATIVE PION PRODUCTION ON NEUTRON NUMBER. Walter F. Dudziak and Ryokichi Sagane. [Aug. 1953] 5p. (UCRL-2304)

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NOTE ON THE SCATTERING OF MANY PARTICLE SYSTEMS. S. Tamor. Aug. 21, 1953. 5p. (UCRL-2313)

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THE PRODUCTION OF 320 MEV DEUTERONS BY He^3 STRIPPING. John Ise, Jr., and Robert V. Pyle, Radiation Lab., Univ. of Calif., Berkeley and Donald A. Hicks and Robert M. Main, California Research and Development Co. Sept. 9, 1953. 15p. (UCRL-2319(rev.))

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A CRITERION FOR VACUUM SPARKING DESIGNED TO

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THE SEPARATION OF THE FOUR PLATINUM GROUP METALS, PALLADIUM, RHODIUM, IRIDIUM AND PLATINUM. P. C. Stevenson, A. A. Franke, R. Borg, and W. Nervik. Aug. 24, 1953. 3p. (UCRL-2329)

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EVIDENCE FOR SUBSHELL AT Z = 96. Glenn T. Seaborg. Sept. 3, 1953. 8p. (UCRL-2335)

UR-250 6161
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MEASUREMENT OF X-RAY BEAM QUALITY BY THE USE OF METAL WALL TO "AIR"-WALL CHAMBER RATIOS. Adrian H. Dahl. Apr. 30, 1953. 151p. (UR-250)

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DESIGN FOR A NEOPRENE GLOVE FOR USE IN DRY BOXES. Robert H. Wilson. July 28, 1953. 13p. (UR-265)

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THE ANALYTICAL CHEMISTRY OF MICRO-QUANTITIES OF BERYLLIUM. Taft Y. Toribara and Ruth E. Sherman. July 15, 1953. 25p. (UR-267)

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A FLEXIBLE AURAL INDICATING ALPHA SURVEY INSTRUMENT. R. E. Vosteen. June 3, 1953. 32p. (UR-270)

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THE SHORTENING OF LIFE SPAN BY INJECTED RADIUM, POLONIUM AND PLUTONIUM. H. A. Blair. Sept. 8, 1953. (UR-274)

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AD-475 6026
Engineering Research Inst., Univ. of Mich.
DEVELOPMENT OF PROCEDURES FOR THE IDENTIFICATION OF MINOR PHASES IN HEAT-RESISTANT ALLOYS BY ELECTRON DIFFRACTION. PROGRESS REPORT, APRIL 15 TO JULY 15, 1952. L. O. Brockway and W. C. Bigelow. 19p. (AD-475; Progress Report 2)

AF-TR-6519(pt.2) 6047
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MATERIALS FOR HANDLING FUMING NITRIC ACID. PART 2. PROPERTIES OF FUMING NITRIC ACID WITH REFERENCE TO ITS THERMAL STABILITY. Mars G. Fontana. Nov. 1952. 112p. (AF-TR-6519(pt.2); AD-6457)

AMRL-110 5901
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THE INFLUENCE OF IONIZING RADIATION ON MITOSIS IN THE CORNEAL EPITHELIUM OF THE RAT. 1. MORPHOLOGICAL CHANGES INDUCED BY X-IRRADIATION AND THE EFFECTIVENESS OF BAL AND CYSTEINE IN REDUCING THE FREQUENCY OF THESE CHANGES. Robert G. Ransom. Jan. 12, 1953. 15p. (AMRL-110)

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INSTRUMENTATION AND FUNDAMENTAL EXPERIMENTS IN PLASTICITY. D. C. Drucker and F. D. Stockton. June 1952. 60p. (ATI-162676; U-23187; Technical Report 68)

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MATRIX INVERSION BY PARTITIONING. Mark Lotkin and Russell Remage. July 1952. 53p. (BRL-823)

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TESTS OF TEMPERATURE-RESISTANCE RELATIONS FOR INSULATING MATERIALS. J. E. Bigelow. Sept. 16, 1949. 7p. (DF-49GL151)

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Fluid Motion Sub-Committee, Aeronautical Research Council (Great Britain)
THEORETICAL CONSIDERATIONS ON FREE CONVECTION IN TUBES. M. J. Lighthill. July 21, 1952. 44p. (FM-1758)

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STRATIGRAPHIC SECTIONS OF THE PHOSPHORIA FORMATION IN MONTANA, 1948. M. R. Klepper, F. S. Honkala, O. A. Payne, and E. T. Ruppel. 1953. 41p. (GS-C-260)

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RESULTS OF RECONNAISSANCE FOR RADIOACTIVE MINERALS IN PARTS OF THE ALMA DISTRICT, PARK COUNTY, COLORADO. Charles T. Pierson and Q. D. Singewald. 1953. 12p. (GS-C-294)

HE-150-93 5996
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GENERALIZED THEORY OF CONVECTIVE HEAT TRANSFER IN A FREE-MOLECULE FLOW. A. K. Oppenheim. Mar. 18, 1952. 27p. (HE-150-93; ATI-158453)

HE-150-110 6128*
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AERODYNAMIC FORCES ON A CYLINDER FOR THE FREE MOLECULE FLOW OF A NON-UNIFORM GAS. S. Bell and S. A. Schaaf. Dec. 19, 1952. 16p. (HE-150-110; AD-1910)

ML-205 6206
Microwave Lab., Stanford Univ.
HIGH ENERGY ELECTRON SCATTERING AND NUCLEAR STRUCTURE DETERMINATIONS. R. Hofstadter, H. R. Fechter, and J. A. McIntyre. Aug. 1953. 37p. (ML-205)

MR-496 6003
Pitman-Dunn Labs., Frankford Arsenal
USE OF A PORTABLE ROCKWELL HARDNESS TESTER AND EXAMINATION OF TEST RESULTS ON STANDARD CALIBRATION BLOCKS. M. A. Dougherty and W. L. Boyer. Feb. 1952. 10p. (MR-496; ATI-156112)

NAVORD-2455 6129
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APPARATUS FOR MEASUREMENT OF PVT RELATIONSHIPS OF GASES AT HIGH TEMPERATURES AND PRESSURES: EFFECTS OF CHANGING THE INITIAL OPERATING CONDITIONS. Robert S. Allgaier. June 3, 1952. 26p. (NAVORD-2455)

NBS-1904 5956
National Bureau of Standards
CALORIMETRIC PROPERTIES OF POLYTETRAFLUOROETHYLENE (TEFLON) FROM 0° TO 365°K. George T. Furukawa, Robert E. McCoskey, and Gerard J. King. Sept. 2, 1952. 30p. (NBS-1904; AD-1878)

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OSCILLATOR STRENGTH OF IONIZING TRANSITIONS. DATA CALCULATED IN THE HYDROGENLIKE APPROXIMATION. Margaret N. Lewis. Apr. 21, 1953. 123p. (NBS-2457)

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NBS-2654 6138
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PROCEEDINGS OF SYMPOSIUM ON BARIUM TITANATE ACCELEROMETERS HELD IN WASHINGTON, D. C., MAY 14-15, 1953. Thomas A. Perls, comp. Aug. 1953. 228p. (NBS-2654)

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NP-4717 5924
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EFFECT OF COAGULATION ON THE FILTRABILITY AND COST OF FILTRATION OF SURFACE WATER. QUARTERLY REPORT [FOR] SEPTEMBER 1, 1952 THROUGH NOVEMBER 30, 1952. Harold E. Babbitt and E. Robert Baumann. Dec. 10, 1952. 41p. (NP-4717; Quarterly Report 1; AD-339)

NP-4719 6057
Metals Research Lab., Carnegie Inst. of Tech.
THE FREE ENERGY CHANGE OF AUSTENITE-PEARLITE TRANSFORMATIONS; ANNUAL REPORT [FOR] JUNE 1, 1952 TO JUNE 1, 1953. Guy M. Pound and William C. Hagel. June 16, 1953. 20p. (NP-4719)

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Colorado Univ.
DESCRIPTION OF A NEW DETECTOR SYSTEM FOR LUMINESCENCE IN THE INFRARED; ENERGY DISTRIBUTION IN LUMINESCENCE SPECTRA OF ORGANIC COMPOUNDS. Bruno Witte, Inge Witte, and Frank E. E. Germann. [1953] 21p. (NP-4721; Technical Report 1)

NP-4732 6058
Massachusetts Inst. of Tech.
DIFFUSION PROCESSES ASSOCIATED WITH METALLURGICAL PHENOMENA; PROGRESS REPORT FOR THE PERIOD AUGUST 1952 TO NOVEMBER 1952. [nd] 9p. (NP-4732; Progress Report 5; AD-8263)

NP-4739 5925
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Battelle Memorial Inst.
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NP-4770 6114
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THE DISTORTION OF A CRYSTAL BY POINT IMPERFECTIONS. J. D. Eshelby. July 1953. 27p. (NP-4770; Technical Report 9)

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AN APPARATUS FOR THE CONTROLLED DISPERSION

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NP-4786 6063
Magnesium Labs., Dow Chemical Co.
FUNDAMENTALS OF HOW ALLOYING INGREDIENTS AFFECT PROPERTIES OF MAGNESIUM. QUARTERLY STATUS REPORT, DECEMBER 1, 1950 TO MARCH 1, 1951. 13p. (NP-4786; Quarterly Status Report 3)

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NP-4797 6263
Illinois Univ.
COLOR CENTERS AND TRAPPED CHARGE IN ALKALI HALIDE CRYSTALS (thesis). David Bellamy Dutton. July 1952. 71p. (NP-4797; U-23200; Technical Report 5)

NP-4800 6065
[Yale Univ.]
STUDY OF VARIOUS ASPECTS OF THE DIFFUSION PROCESS IN ALLOYS APPLYING THE RELAXATION METHOD. PROGRESS REPORT FOR THE PERIOD JULY 1–SEPTEMBER 30, 1952. Arthur S. Nowick. Oct. 7, 1952. 8p. (NP-4800; ATI-174950; Progress Report 2)

NP-4804 6130
Palmer Physical Lab., Princeton Univ.
RADIO FREQUENCY TRANSITIONS BETWEEN HYPERFINE LEVELS OF ATOMIC HYDROGEN; INVESTIGATION OF THE EFFECT OF GAS COLLISIONS UPON THE DOPPLER BREADTH OF SPECIAL LINES. QUARTERLY REPORT, DECEMBER 15, 1952 THROUGH APRIL 15, 1953. R. H. Dicke. 8p. (NP-4804; AD-9824; Quarterly Report 3)

NP-4805 6006
Ceramic Lab., Pass and Seymour, Inc.
CERAMIC DENSE ZIRCON LOW-LOSS MATERIAL; FINAL REPORT, DECEMBER 1, 1950–JUNE 25, 1952. F. P. Hall. June 25, 1952. 26p. (NP-4805; ATI-157933)

NP-4806 6141
Georgia Inst. of Tech., State Engineering Experiment Station
INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, PROGRESS REPORT, SEPTEMBER 30, 1952 TO DECEMBER 1, 1952. Vernon Crawford, James C. Hogg, Jr., and William H. Bradley. 32p. (NP-4806; Progress Report 7; AD-4995)

NP-4814 6285
Engineering Research Inst., Univ. of Mich.
INFRARED STUDIES OF CRYSTALS. QUARTERLY REPORT [FOR] PERIOD AUGUST 15, 1952 TO NOVEMBER 15, 1952. G. B. B. M. Sutherland, R. T. Mara, and W. G. Simeral. Nov. 1952. 10p. (NP-4814; AD-4193; Quarterly Report 5)

NP-4819 6092
Utah Univ.
THE DETERMINATION OF THE NATURAL FREQUENCIES OF SPECIAL BEAM CONFIGURATIONS. STUDIES IN APPLIED MATHEMATICS NO. 5. L. C. Barrett and C. R. Wylie, Jr. Apr. 1, 1952. 82p. (NP-4819; Technical Report 3)

NP-4821 6066
Research and Development Board
SYMPOSIUM ON VAPOR DEPOSITION OF METALS. May 8, 1950. 80p. (NP-4821; ATI-193932)

NP-4824 5927
Cryogenic Lab., Ohio State Univ.
COMPUTATION OF THERMODYNAMIC PROPERTIES OF GASES FROM SPECTRA N_2. Leonard Glatt, Jack Belzer, and Herrick L. Johnston. July 15, 1953. 21p. (NP-4824; TR-316-9)

NP-4829 6067
Institute of Engineering Research, Univ. of Calif., Berkeley
EFFECT OF COLD WORK ON THE HIGH TEMPERATURE CREEP PROPERTIES OF DILUTE ALUMINUM ALLOYS. Robert E. Frenkel, Oleg D. Sherby, and John E. Dorn. Aug. 1, 1953. 26p. (NP-4329; Technical Report 29)

NP-4830 6068
Institute of Engineering Research, Univ. of Calif., Berkeley
A RECOVERY MODEL FOR THE HIGH TEMPERATURE CREEP PROCESS. O. D. Sherby and J. E. Dorn. Aug. 15, 1953. 18p. (NP-4830; Technical Report 30)

NP-4831 6069
New York Univ. Coll. of Engineering
AN ANALYSIS OF THE ORTHOGONAL BORING OPERATION. Bernard W. Shaffer. Aug. 1953. 38p. (NP-4831; Technical Report 1)

NP-4836 6008
Rock Island Arsenal Lab.
COMPARISON OF RUST PROTECTIVE QUALITIES OF VARIOUS MATERIALS ON BARE STEEL, OXIDE BLACKENED, AND PARKERIZED SURFACES. H. Faigen. July 8, 1942. 9p. (NP-4836; AD-162)

NP-4837 6286
Arkansas Univ. Engineering Experiment Station
DEVELOPMENT OF AN INSTRUMENT FOR THE INSTANTANEOUS ANALYSIS OF GAS MIXTURES. QUARTERLY PROGRESS REPORT, JULY 1, 1952 TO SEPTEMBER 30, 1952. Oct. 21, 1952. 12p. (NP-4837; AD-455; Quarterly Progress Report 3)

NP-4843 6070
North Carolina State Coll.
A METALLOGRAPHIC STUDY OF THE SOLIDIFICATION OF CASTINGS. FINAL REPORT [FOR] PERIOD JUNE 12, 1951 TO JUNE 12, 1952. B. F. Brown. July 12, 1952. 59p. (NP-4843; ATI-171745)

NP-4847 6115
Solid-State and Molecular Theory Group, Mass. Inst. of Tech.
ELECTRONIC STRUCTURE OF SOLIDS. 1. THE ENERGY BAND METHOD. John C. Slater. July 15, 1953. 124p. (NP-4847; Technical Report 4)

NP-4851 6093
Research Lab. of Electronics, Mass. Inst. of Tech.
PROPAGATION OF AN ELECTROMAGNETIC WAVE ALONG A HELIX SURROUNDED BY A RESISTANCE SHEATH. Andreas Tonning. May 13, 1952. 13p. (NP-4851; Technical Report 232)

NP-4855 6071
Battelle Memorial Inst.
THE EFFECT OF HYDROGEN ON THE MECHANICAL PROPERTIES OF TITANIUM ALLOYS. SUMMARY REPORT. G. A. Lenning, C. M. Craighead, and R. I. Jaffee. July 31, 1953. 84p. (NP-4855)

NP-4857 5998
Stanford Univ.
BASIC HEAT TRANSFER AND FLOW FRICTION DESIGN DATA FOR GAS FLOW TO BANKS OF STAGGERED TUBES: USE OF A TRANSIENT TECHNIQUE. W. M. Kays and R. K. Lo. Aug. 15, 1952. 104p. (NP-4857; Technical Report 15)

NP-4858 5999
Stanford Univ.
HEAT TRANSFER AND FLOW FRICTION CHARACTERISTICS OF POROUS MEDIA. J. E. Coppage. Dec. 1, 1952. 77p. (NP-4858; Technical Report 16)

NP-4860 5928
University of Southern Calif.
A PROPOSED APPROACH TO THE "CHELATE EFFECT." Arthur W. Adamson. [1953] 5p. (NP-4860)

NP-4865 5945
Coates Chemical Labs., Louisiana State Univ.
INVESTIGATIONS OF SPOT TEST METHODS OF ANALYSIS. Philip W. West, Charles G. DeVries, William C. Hamilton, Louis J. Conrad, Theo McCoy, and Jack K. Carlton. May 5, 1952. 24p. (NP-4865; U-23310; ATI-161979)

NP-4874 6156*
Research Lab. of Electronics, Mass. Inst. of Tech.
LECTURES ON COMMUNICATION THEORY. D. Gabor. Apr. 3, 1952. 50p. (NP-4874; Technical Report 238)

NP-4890 6072
[Special Library Association]
BIBLIOGRAPHY OF RECENT LITERATURE ON METALS AT ELEVATED TEMPERATURES. G. Meixell Snyder and F. Edith Manley. [Oct. 15, 1951] 26p. (NP-4890)

NRL-4111 6142
Naval Research Lab.
PORTABLE PRECISION FREQUENCY METER. PART 3. SIMPLIFIED DIRECT-READING METER. G. K. Jensen and J. E. McGeogh. Mar. 31, 1953. 22p. (NRL-4111)

NRL-4179 6094
Naval Research Lab.
DAMAGES RESULTING FROM LABORATORY VIBRATION AND HIGH-IMPACT SHOCK TESTS. Kenneth E. Woodward. Sept. 11, 1953. 36p. (NRL-4179)

NRL-4197 6207
Naval Research Lab.
GAMMA RADIATION FROM INTERACTION OF 14-MEV NEUTRONS WITH VARIOUS ELEMENTS. V. E. Scherrer, R. B. Theus, and W. R. Faust. June 22, 1953. 27p. (NRL-4197)

NRL-Memo-197 6005
Naval Research Lab.
THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS; PROGRESS REPORT FOR [PERIOD] MAY 1 TO AUGUST 1, 1953. D. D. Williams and C. T. Ewing. Aug. 12, 1953. 10p. (NRL-Memo-197; Progress Report 6)

RL-463 6073
General Electric Research Lab.
SURFACE AND INTERFACIAL TENSIONS OF SINGLE-PHASE SOLIDS. J. C. Fisher and C. G. Dunn. Nov. 1950. 39p. (RL-463)

TEI-56 6016
Geological Survey
RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN THE EAGLE-NATION AREA, EAST-CENTRAL ALASKA, 1948. Helmuth Wedow, Jr. Aug. 1953. 27p., 1 illus. (TEI-56)

TEI-333 6269
Geological Survey
TABLES FOR THE CALCULATION OF RADIOACTIVE EQUILIBRIUM FROM BATEMAN'S EQUATION. F. J. Flanagan and F. E. Senftle. July 1953. 18p. (TEI-333)

TEM-422 6017*
Geological Survey
RED ROCK VALLEY SW, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-422)

TEM-423 6018*
Geological Survey
DINNE MESA NE, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-423)

TEM-424 6019*
Geological Survey
DINNE MESA SE, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. August 1952. 2p., 1 illus. (TEM-424)

TEM-425 6020*
Geological Survey
PASTORA PEAK NE, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA AND NORTHWESTERN NEW MEXICO. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-425)

TEM-426 6021*
Geological Survey
PASTORA PEAK NW, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-426)

TEM-427 6022*
Geological Survey
PASTORA PEAK SE, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA AND NORTHWESTERN NEW MEXICO. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-427)

TEM-428 6023*
Geological Survey
PASTORA PEAK SW, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-428)

TEM-430 6024*
Geological Survey
LOS GIGANTES SW, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. Aug. 1952. 3p., 1 illus. (TEM-430)

TRE-TN-174 6143*
Telecommunications Research Establishment (Great Britain)
COMPONENTS FOR TRANSISTORS. G. W. A. Dummer and A. L. Gregory. Nov. 5, 1952. 4p. (TRE-TN-174)

UMN/S35 5934*
Minnesota Univ.
INVESTIGATION OF REACTIONS OF NITROGEN OXIDES WITH THE FAST-SCANNING INFRARED SPECTROMETER. PROGRESS REPORT. George R. Cowan, Arthur R. Downie, and David L. Rotenberg. Jan. 1, 1952. 25p. (UMN/S35; AD-6520)

USNRDL-405 5898
Naval Radiological Defense Lab.
EFFECT OF REGIONALLY FRACTIONATED X-IRRADIATION EQUIVALENT IN DOSE TO ACUTELY LETHAL TOTAL BODY EXPOSURE. M. N. Swift, S. T. Taketa, and V. P. Bond. Mar. 27, 1953. 21p. (USNRDL-405)

WADC-TR-52-291 6076
Wright Air Development Center
AN INVESTIGATION OF VARIOUS PROPERTIES OF NiAl. Richard L. Wachtell, American Electro Metal Corp. Sept. 1952. 44p. (WADC-TR-52-291; AD-12965)

WAL-401/45-26 6074
Battelle Memorial Inst.
CHEMICAL SURFACE TREATMENT OF TITANIUM; INTERIM TECHNICAL REPORT. H. A. Pray, P. D. Miller, and Richard A. Jefferys. May 30, 1953. 48p. (WAL-401/45-26; Interim Technical Report 3)

WAL-401/68-28 6075
Carnegie Inst. of Tech.
THE EFFECT OF INTERNAL HEATING ON THE FATIGUE PROPERTIES OF TITANIUM, INTERIM REPORT. J. P. Romualdi and E. D'Appolonia. July 1953. 91p. (WAL-401/68-28)

WIS-OOR-3 6131
Naval Research Lab., Univ. of Wis.
THE KINETIC THEORY OF DENSE GASES. C. F. Curtiss. [1953] 49p. (WIS-OOR-3; AD-6699)

NUCLEAR SCIENCE ABSTRACTS

Vol. 7 Nov. 30, 1953 No. 22

GENERAL

RESEARCH PROGRAMS

5893

Brookhaven National Lab.

QUARTERLY PROGRESS REPORT, APRIL 1–JUNE 30, 1953: UNCLASSIFIED SECTION. 58p. (BNL-243)

Abstracts are given for activities concurrently published in the scientific journals. These abstracts cover topics on physics, chemistry, medicine, and biology. Additional progress is reported on the following: counter amplifier and power supply designs; operation and research programs for the cosmotron, 18-in. and 60-in. cyclotron, and research electrostatic generator; the effect of γ radiation on polymerization of styrene, acrylamide, and perfluorinated monomers; and comparative sensitivity of chromosomes to thermal neutron and x radiation. (For preceding period see BNL-232.) (K.S.)

BIOLOGY AND MEDICINE

5894

Johns Hopkins Hospital

A HEMORRHAGIC DISORDER OCCURRING IN PATIENTS WITH CONGENITAL HEART DISEASE. Robert C. Hartmann. [nd] 45p. (AECU-2682)

Clinical findings in 39 patients with congenital heart disease are summarized. A high incidence of potential hemorrhagic diathesis was found in the cyanotic group. Some observations concerning the etiology of this condition are included. (C.H.)

5895

LOW-COST I^{131} THYROID UPTAKE APPARATUS. Edward Siegel. Nucleonics 11, No. 10, 64(1953) Oct.

The apparatus described utilizes an overbed hospital table to support a Pb-shielded Radiation Counter Lab. Mark 1 Model 12 bismuth-wall γ counter. Since only tracer doses of I^{131} are used, high sensitivity is required, emphasizing the need for shielding adequate to exclude counts emanating from extrathyroidal sources such as the bladder. The shielded tube in its counting position is about 7 in. above the skin and has a sensitivity of about 100 cpm/μc of I^{131}. (L.M.T.)

5896

GENESIS OF RESPIRATORY AND CIRCULATORY CHANGES IN BLAST INJURY. Carl-Johan Clemedson and H. Pettersson. Am. J. Physiol. 174, 316-20(1953) Aug.

By protecting the bodies of the experimental animals with the exception of their heads and by previous bilateral vagotomy and anesthesia of the carotid sinus region it has been possible to determine the origin of the respiratory and circulatory changes in rabbits exposed to the shock waves from a detonating high explosive. These experiments lead to the conclusion that the changes in respiration and circulation are entirely or almost entirely of peripheral origin. Usually there seems to be no cerebral concussion component in the blast syndrome. The instantaneous acceleration of respiration is solely due to vagal reflexes elicited in the damaged lungs. Changes in circulation are of a two-fold genesis. The initiation of the bradycardia and the blood pressure fall seem to be caused by the blast pressure acting externally on the carotid sinus region. The more prolonged effects, on the other hand, are due to reflexes evoked in the damaged lungs. This is especially marked as far as blood pressure is concerned. (auth)

AEROSOLS

5897

DUST COUNTING BY THE MOST PROBABLE NUMBER METHOD. Harlow M. Chapman. Arch. Ind. Hyg. and Occupational Med. 8, 234-45(1953) Sept.

The most probable number method is briefly reviewed, and the mathematical derivation as applied to dust counting is given. Procedures for applying it to the standard method of dust counting are explained. Experimental data from 172 cells are given to show that the average most probable number is 90% of the average count, and the correlation coefficient is 0.92. The reliability of the two methods is about equal, as the coefficient of variation is 7.9% for most probable number and 6.3% for count. Further data are presented to show that the time required by the most probable number method will average only one-third the time required by the standard count. It is believed that the most probable number method will considerably decrease the fatigue and annoyance of dust counting. (auth)

RADIATION EFFECTS

5898

Naval Radiological Defense Lab.

EFFECT OF REGIONALLY FRACTIONATED X-IRRADIATION EQUIVALENT IN DOSE TO ACUTELY LETHAL TOTAL BODY EXPOSURE. M. N. Swift, S. T. Taketa, and V. P. Bond. Mar. 27, 1953. 21p. (USNRDL-405)

Mortality following exposure of the entire body to acutely lethal doses of x radiation was considerably reduced in mice, and to a lesser degree in rats, by irradiating the abdomen shortly before, or following, the remainder of the body. An appreciable decrease in radiation mortality was also obtained in mice by shielding the exteriorized spleen during exposure, even though the spleen alone had been irradiated with the same dose prior to exposure of the body. The time intervals allowed between exposures in these experiments ranged from 10 min to 4 hr. Possible explanations for these findings are discussed in the light of current concepts regarding recovery from radiation injury, and it is suggested that the results may be indicative of the action of a recovery factor or factors emanating from the body region shielded during the first irradiation in each instance. (auth)

5899

Biological Research Lab., Southern Ill. Univ.

EVIDENCE FOR TWO DIFFERENT TYPES OF X-RAY DAMAGE REVEALED BY ANALYSIS OF RETARDATION OF BUDDING IN SACCHAROMYCES. Alvin Sarachek,

Ernest Shult, and Carl C. Lindegren. [1953] 15p. (AECU-2647)

An analysis of x-radiation-induced retardation of budding in Saccharomyces is presented, which reveals that two different and independent types of damage occur. One type of damage is shown to increase exponentially throughout the entire exposure period, whereas the other type of damage accumulates exponentially until the dose characteristic for the cell is received, after which all cells are protected from further injury of this type. Data are presented graphically on the effect of both types of radio-induced damage on survival and budding of haploid, diploid, triploid, and tetraploid yeast cells. (C.H.)

5900

Wisconsin Univ.

STUDIES ON LOW DOSE X-IRRADIATIONS AND ITS EFFECT UPON THE BIOCHEMISTRY AND PATHOLOGY OF THE DOG. PROGRESS REPORT, JUNE 1952 TO MAY 1953. P. H. Phillips. [1953] 8p. (AECU-2680)

Splenectomized and non-splenectomized dogs given 100 r/wk x radiation showed no difference in life expectancy when compared to non-irradiated dogs. The addition of trace amounts of Co, Cu, and Mn to the diet of splenectomized and non-splenectomized adult rats receiving low-dose, intermittent x irradiation did not alter the erythrocyte fragility. Progress is reported in studies of the effects of low-dose, intermittent x irradiation on the life expectancy, reproduction, blood protein levels, and production of eye opacities in dogs. Preliminary studies on rats indicated an effect of local x irradiation of the femur on the morphology of bone marrow cells. It was determined that fluid milk may be used as a medium for administering prophylactic substances to x-irradiated rats. Progress is reported in a study of fatty acid metabolism by rats. (C.H.)

5901

Army Medical Research Lab., Fort Knox

THE INFLUENCE OF IONIZING RADIATION ON MITOSIS IN THE CORNEAL EPITHELIUM OF THE RAT. 1. MORPHOLOGICAL CHANGES INDUCED BY X-IRRADIATION AND THE EFFECTIVENESS OF BAL AND CYSTEINE IN REDUCING THE FREQUENCY OF THESE CHANGES. Robert G. Ransom. Jan. 12, 1953. 15p. (AMRL-110)

X rays produce mitotic aberrations in the corneal epithelial cells of the rat. Two effects were observed: a "physiological effect" produced in those cells which were dividing at the time of exposure and characterized by chromosome stickiness resulting in bridges at anaphase and telophase; and a "structural effect" produced in the interphase or early prophase cells but becoming apparent only at division and characterized by chromosome fragments and chromosome bridges in the anaphase and telophase. The "structural effect" was demonstrated in Wistar and Sprague-Dawley rats, in young and adult animals, in animals exposed to local and total body irradiation, and in animals exposed to hard as well as soft x rays. Cysteine instillation was observed to reduce the frequency of the "structural effects," but the instillation of BAL proved ineffective. (auth)

5902

Argonne National Lab.

DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] NOVEMBER AND DECEMBER 1952, AND JANUARY 1953. Austin M. Brues, ed. 149p. (ANL-4948)

Separate abstracts have been prepared on three sections of this report. (For preceding period see ANL-4932.) (C.H.)

5903

Argonne National Lab.

CHRONIC EXTERNAL IRRADIATION, NEUTRON RADIOBIOLOGY, PHYSIOLOGY, HISTOPATHOLOGY, AND RADIOCHEMISTRY. p.11-55 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] NOVEMBER AND DECEMBER 1952, AND JANUARY 1953. Austin M. Brues, ed. 45p. (ANL-4948(p.11-55))

Data are tabulated from a study of the long-term survival of mice exposed to an acute dose of x radiation with and without spleen protection. The histopathology of leukemia in guinea pigs is described. No permanent regression of transplanted lymphatic leukemia in guinea pigs was obtained with various treatments, including splenectomy before transplantation followed by x irradiation, x irradiation followed by bone marrow injections, intraperitoneal injections of aminopterin followed by x irradiation, and single and multiple doses of x radiation alone. Injections of homogenates of a number of different organs were tested for their protective effect on survival of mice following 900 r total-body x irradiation. Only hematopoietic or closely-related tissues afforded any protection. Preliminary data are presented on the appearance and progression of radiation cataracts following exposure of mice to fast neutrons. Observations made at autopsy of 100 mice irradiated with fast neutrons, γ radiation, or mixtures are summarized. Survival curves are included for mice after single 90-min irradiation with fast neutrons or γ radiation. Survival studies were carried out on mice following inoculation with Krebs-2 ascitic tumor cells preliminary to studies of tumor physiology and growth. Preliminary electron microscopic observations on the solvation and reconstitution of collagenous fibrils are described and illustrated. A remotely controlled pipetting apparatus for the dispensing, diluting, and sampling of radioactive solutions is described and illustrated. (C.H.)

5904

Argonne National Lab.

RADIUM TOXICITY, EXPERIMENTAL PATHOLOGY, SPECIAL PROBLEMS, INVERTIBRATE ZOOLOGY, AND MICROBIOLOGY. p.56-79 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] NOVEMBER AND DECEMBER 1952, AND JANUARY 1953. Austin M. Brues, ed. 24p. (ANL-4948(p.56-79))

An apparatus for supplying aged air to subjects and collecting Rn from the expired air is illustrated, and data on the normal body content of Ra, as determined by analysis of Rn in the breath, are presented for seven unexposed subjects. Survival data for mice, based on 980 CF-1 mice, are presented. Reduced vigor and viability were demonstrated for clones of Paramecium isolated immediately after exposure to usually sublethal doses of x radiation. The mean femoral arterial blood pressure of adult white leghorn cocks was determined to be 135 mm Hg. Data are presented on the effects of x radiation on blood pressure in roosters. Observations are reported on the Golgi bodies, mitochondria, and spindle fibers of the germ cells of Helex, as revealed with the phase-contrast and electron microscopes. Data are presented graphically on the influence of 50-kv x radiation upon survival of B. megaterium spores in the dry state on millipore filters, and the use of these filters in radiation studies of bacteria is discussed. A study of the effect of x radiation on innate and acquired immunity of mice infected with the nonpathogenic protozoan blood parasite Trypanosoma duttoni indicate that the spleen plays a large part in the maintenance of innate immunity, that rapid reconstitution of the spleen occurs when the spleen is irradiated and the body is shielded, but that when the body is irradiated and the spleen is shielded, the spleen may still suffer radiation damage. (C.H.)

5905

Argonne National Lab.

PHYTORADIOBIOLOGY, PLANT PHYSIOLOGY, PHYSICAL

CHEMISTRY, PHARMACOLOGY, THEORETICAL BIOLOGY, AND BIOPHYSICS. p.80-142 of DIVISION OF BIOLOGICAL AND MEDICAL RESEARCH QUARTERLY REPORT [FOR] NOVEMBER AND DECEMBER 1952, AND JANUARY 1953. Austin M. Brues, ed. 63p. (ANL-4948(p.80-142))

Additional data are included from a study of the biosynthesis of auxin. Data are reported from studies of the effect of photoperiod and natural and synthetic growth regulators on the growth and development of red kidney beans; the effect of photoperiod on growth, development, and rutin production in buckwheat; studies of the role of B in plant nutrition; methods for the quantitative spectrophotometric determination of rutin and other flavonoids in plants and plant products; and a study of the preparation of dextran for clinical use. A protective effect of aurintricarboxylic acid was demonstrated in mice following repeated injections of the LD_{95} of Be sulfate. No appreciable difference in blood urea values was demonstrated in rats following exposure to 1000 r x radiation. Evidence is presented which indicates that the survival of ultraviolet-irradiated bacteria is dependent to an important degree on the H ion concentration in the agar into which the bacteria are plated after irradiation. Data on the ionization distribution functions of the radiation from P^{32}, Y^{91}, Tl^{204}, and Bi^{210} are presented graphically. Factors which influence the operating stability of ionization-type halogen detectors were studied. Data are presented on the performance of four fast neutron detection chambers tested under various combinations of γ and neutron radiation. Progress is reported in the preparation of hydrocarbon scintillators for use as fast neutron detectors. (C.H.)

5906

MODIFICATION OF THE FRAGILITY OF ERYTHROCYTES IN THE WHOLE-BODY-IRRADIATED GUINEA PIG. Odette Lartigue and Jean-François Duplan. Compt. rend. 237, 359-60(1953) July 27. (In French)

Thermal fragility of erythrocytes was studied in guinea pigs irradiated with 500 r of x rays. The fragility of red cells heated to 54°C in hypotonic gluocose medium increased progressively from the sixth to the twelfth day. Morphological modifications of the red cells appeared concurrently. (G.Y.)

RADIATION HAZARDS AND PROTECTION

5907

Atomic Energy Project, Univ. of Rochester

DESIGN FOR A NEOPRENE GLOVE FOR USE IN DRY BOXES. Robert H. Wilson. July 28, 1953. 13p. (UR-265)

When currently available gloves of pure gum rubber proved unsuitable for use in dry boxes because of adsorption of radon, lack of inherent strength, and lack of resistance to chemicals, it was decided to undertake the construction of a special neoprene glove which would meet specifications. Such a glove has now been produced of a specially compounded low-porosity lattice. The lower elasticity of neoprene as compared to pure gum has been compensated by use of an unusually thin film, ranging from 0.006 in. to 0.014 in. which yields a high degree of feel. The glove is available in medium and large sizes, 39 to 40 in. long, and is designed to fit a 9-in. port at this length. Both sizes have a neutral thumb, in order to fit either hand comfortably. (auth)

5908

HANDLING EQUIPMENT AND SAFETY CONTAINERS FOR USE WITH ISOTOPE γ-RAY SOURCES FOR INDUSTRIAL RADIOGRAPHY. D. R. Allen, H. S. Peiser, and J. R. Rait. Brit. J. Appl. Phys. 4, 268-73(1953) Sept.

The safe use of active γ sources for radiography in non-destructive testing laboratories requires efficient containing and handling equipment. The design and construction of a complete set of such tools is described. These comprise (a) source adaptor, plug and container with trolley for safe storage; (b) source-transfer equipment, adjustable rods, stands with quick-release clamps, and spider supports for remote handling; and (c) special sighting cones and jigs, used prior to positioning the source for exposure, to avoid unnecessary handling. (auth)

5909

TESTING OF MATERIALS WITH GAMMA AND BETA RAYS. II. GAMMA SOURCES AND THEIR MANIPULATION; PROTECTION FROM RADIATION. E. A. W. Müller. Arch. tech. Messen 209, 131-4(1953) June. (In German) (cf NSA 6-4772).

Practical measures for handling and using Ir, Ta, and Co sources of γ radiation are discussed. Their effects on human organisms are described, and a table of protective screen dimensions for a maximum weekly dosage of 0.3 r and a nomograph for estimating shield thicknesses for various protective materials for Co^{60} radiation are presented. Photos illustrate a protective carrier for handling a source. (E.S.)

TOXICOLOGY STUDIES

5910

Atomic Energy Project, Univ. of Rochester

THE SHORTENING OF LIFE SPAN BY INJECTED RADIUM, POLONIUM AND PLUTONIUM. H. A. Blair. Sept. 8, 1953. (UR-274)

It is shown that the life-span dose relationship for Po poisoning in the rat can be represented by equations applied previously (UR-206 and 207) to data on penetrating ionizing radiation. These equations are based on the hypothesis that radiation produces injury which is reversible in part and irreversible in part and that life shortening is a measure of the total injury, unrepaired plus irreparable injury, existing at the time of death. Semi-empirical equations derived from the same hypothesis for Ra and Pu poisoning permit easy handling of data on the rat and mouse and easy comparison of these elements with Po. The apparent biological effectiveness of Po α radiation is about 3 in comparison to x rays for acute effects and about 60 for chronic effects; injury is 80% irreversible with Po compared to 4% with x rays. The chronic toxicities of Po and Pu are each about 5 compared to Ra. (auth)

5911

OBSERVATIONS ON THE FIXATION IN VITRO OF URANIUM TO SECTIONS OF BONE. R. Amprino. Experientia 9, 291-3(1953) Aug. 15. (In English)

Preliminary results are reported of an autoradiographic study of sections of whole fresh bone, bone fixed in ethanol or formalin, and bone freed of its organic components which had been treated with 0.1% uranyl nitrate in a 0.025N buffer of $NaHCO_3$. The distribution of U is qualitatively the same as that of Ca^{45}, but the differential uptake in recent as compared to old bone tissue is much greater for Ca^{45} than for U. Removal of the organic components increases the ability of bone tissue to fix U. The U partially replaces Ca^{45} previously fixed but causes no change in the relative distribution of Ca^{45}. Concurrent fixation of Ca^{45} and U takes place, and sections treated with U can still fix a remarkable amount of Ca^{45}. Nearly all the U can be removed by treatment with 0.025N $NaHCO_3$ or Na_2CO_3, by glycol ashing or microincineration at 700°C, or by decalcification with dilute HNO_3. No removal of U occurs on treatment with 0.025N NaCl or Na phosphate solutions. (G.Y.)

TRACER APPLICATIONS

5912

Iowa State Coll.

FORMATION OF 5′-ETHYLTHIOADENOSINE FROM DL-ETHIONINE IN YEAST. F. Schlenk and J. A. Tillotson. [1953] 18p. (AECU-2674)

Yeasts (T. utilis and S. cerevisiae) grown in a medium containing DL-ethionine accumulate a S-containing nucleoside which appears to be 5'-ethylthioadenosine. This biosynthesis resembles the metabolic relation between methionine and methylthioadenosine. (auth)

5913

Oak Ridge Inst. of Nuclear Studies

QUARTERLY PROGRESS REPORT, APRIL 1–JUNE 30, 1953. [1953] 11p. (AECU-2684)

Progress is reported in an investigation of the use of paper chromatography to characterize the various forms of I in blood plasma or urine after the administration of radioiodine as Na iodide or as thyroxine. Data are presented on the tissue distribution of intrapleurally injected colloidal P^{32}-chromic phosphate in rats and dogs and the tissue distribution of intrapleurally injected Y^{90} in rats. Clinical studies reported to be in progress are briefly summarized. (For preceding period see ORO-97.) (C.H.)

5914

Brookhaven National Lab.

THE RATES OF DISTRIBUTION OF SODIUM IN NEPHROTIC CHILDREN. James S. Robertson, James L. Gamble, Jr., and Lee E. Farr. [Submitted Aug. 26, 1953]. 39p. (BNL-1549)

Sodium spaces in a series of nephrotic children ranged from 25 to 69% of the body weight. Equilibration of radioactive Na injected intravenously with that in the ascitic and peripheral edema spaces proceeds at rates indicating Na turnover rates of about 0.2 to 5%/min in these compartments, so several hours may be required for equilibration. The curves obtained depicting the approach to equilibrium do not usually meet the theoretical requirements for interpretation in terms of simple mathematical models. The kinetics of Na exchange is discussed. (auth)

5915

SEPARATE ASSAY OF Fe^{55} AND Fe^{59} IN MIXED PREPARATIONS. W. B. Stewart and H. H. Rossi. Nucleonics 11, No. 10, 66-7(1953) Oct.

For many biological studies in metabolism the simultaneous use of Fe^{55} and Fe^{59} is advantageous. The method described here for their separate assay utilizes a magnetic field of ~1850 gauss which suppresses the Fe^{59} β radiation but does not affect the Fe^{55} x radiation. In a test the sensitivity to Fe^{59} was reduced to ~3%, a residual response due to the γ radiation. The counting efficiency was low (~1% for Fe^{59} and 0.05% for Fe^{55}), but this was adequate for the experiments in progress. The efficiency can be increased by the use of stronger magnetic fields. (L.M.T.)

5916

BORON DETECTION IN TISSUES USING THE (n,α) REACTION. Giovanna Mayr, H. D. Bruner, and Marshall Brucer. Nucleonics 11, No. 10, 21-5(1953) Oct.

H_3BO_3, enriched in B^{10}, was administered to four adult mice which were sacrificed at 12, 24, and 48 hours after injection. Ten tissues were removed from each and sections attached to thin paraffin strips, which were mounted on NTA emulsion so that the section just cleared the surface of the emulsion. After exposure to a neutron flux of 5.76×10^3 neutrons/cm^2/sec for 8 to 14 days, the emulsions were developed and the α tracks counted. Results indicate that the $B^{10}(n,\alpha)Li^7$ reaction can be used to determine B distribution at low concentrations, but that more intense neutron fluxes are needed for improved statistics. (L.M.T.)

CHEMISTRY

5917

Iowa State Univ.

THE STABILITY OF TETRABUTYLAMMONIUM TETRACHLOROIODIDE. Robert E. Buckles and Jack F. Mills. [1953] 17p. (AECU-2645)

Tetrabutylammonium tetrachloroiodide, on illumination either in solution or as a solid, lost HCl and yielded (1-chlorobutyl)tributylammonium ion, which could be further chlorinated to a dichlorotetrabutylammonium ion. No analogous reaction was observed with tetramethylammonium dichloroiodide. The dissociation of tetrabutylammonium tetrachloroiodide into the dichloroiodide and Cl was measured spectrophotometrically. At 25° in acetonitrile the pK of dissociation was 2.70, and in ethylene chloride it was 2.66. Dissociation in trifluoracetic acid was quantitative. The absorption spectrum of tetrabutylammonium tetrachloroiodide in either acetonitrile or ethylene chloride was found to change markedly when the dissociation was suppressed since the absorption characteristic of the dichloroiodide was suppressed. (auth)

5918

Oregon State Coll.

ACID-BASE EXCHANGE REACTIONS IN LIQUID HYDROGEN SULFIDE. T. H. Norris and Robert C. Smith. [1951] 13p. (AECU-2657)

The tracer S^{35} was used to study the rate of exchange between the solvent, liquid H_2S, and the three solutes S, As_2S_3, and P_4S_{10}, the first exchange being investigated with and without added triethylamine, the last two both with added amine only. Exchange occurs in all cases but with widely differing rates (all at room temperature) as follows: (1) S-H_2S, half time ~123 hr; (2) S-H_2S-Et_3N, half time ~30 min; (3) As_2S_3-H_2S-Et_3N, complete in time of experiment; (4) P_4S_{10}-H_2S-Et_3N, 30 to 33% exchange in 12 to 16 min, complete exchange within 10 hr. These results, together with miscellaneous qualitative observations, indicate that, while liquid H_2S does not strikingly demonstrate the properties of a nonaqueous ionizing solvent, there is a certain validity to its being so considered, particularly with respect to the apparent exhibition of amphoterism on the part of such a substance as As_2S_3. (auth)

5919

Argonne National Lab.

PHASE EQUILIBRIA IN THE CONDENSED SYSTEM BROMINE–BROMINE TRIFLUORIDE. Jack Fischer, Robert K. Steunenberg, and Richard C. Vogel. July 1953. 10p. (ANL-5087)

Investigation of the system Br-BrF_3 has shown a liquid immiscibility gap, which intersects the BrF_3 solubility curve. A study of the condensed system indicates that the consolute point is 55.5° ± 0.5°C and 60 ± 5 mole % Br_2. The pure components are the only solid phases observed in the temperature range studied. (auth)

5920

Brookhaven National Lab.

A TECHNIQUE FOR THE PRODUCTION OF THIN SULFUR FILMS. Edward Nielsen and Alfred Weinstein. [nd] 2p. (BNL-1570)

A method is described for preparing thin S films (3mg/cm^2) by deposition of S vapors from the molten element. (K.S.)

5921

Oak Ridge National Lab.

CORROSION TEST ON GLASS COATED STAINLESS STEEL. J. L. English. June 27, 1950. 1p. (CF-50-6-209)

5922

Oak Ridge National Lab.

HEAT CAPACITY OF THE EUTECTIC OF LITHIUM HYDROXIDE AND SODIUM HYDROXIDE. W. D. Powers and G. C. Blalock. May 18, 1953. 2p. (CF-53-5-103)

The enthalpy and heat capacity of the eutectic of LiOH and NaOH (73 mole % NaOH, 27 mole % LiOH) were determined from 260 to 850°C as follows: H_T(liquid)–

$H_{0°C}$ (solid) = 44. + 0.60 T and C_p = 0.60 ± 0.02; where H is the enthalpy in cal/g, T is the temperature °C, and C_p is the heat capacity in cal/g/°C. (Entire report) (auth)

5923
Ames Lab.
MANGANESE(II),-(III),-(IV) EQUILIBRIUM IN IODIC ACID. Glenn R. Waterbury and Don S. Martin, Jr. [Jan. 13, 1953] 27p. (ISC-242)

The equilibrium of the disproportionation reaction of Mn^{+3} has been measured in various aqueous iodate systems by a potentiometric titration method. The dependence of the equilibrium state upon iodate ion, H ion, and iodic acid concentrations and upon the ionic strength and temperature has been studied. The behavior indicates the equilibrium, $Mn^{+4} + Mn^{+2} + 4\ IO_3^- + 3H^+ \rightleftharpoons 2\ Mn^{+3}$, is rapidly established, and equilibrium constants are reported for this reaction. A colorimetric procedure has been developed for the analysis of iodate solutions of Mn^{+3} and Mn^{+4}. The possible ionic species contributing to the equilibrium are discussed. (auth)

5924
Illinois Univ.
EFFECT OF COAGULATION ON THE FILTRABILITY AND COST OF FILTRATION OF SURFACE WATER. QUARTERLY REPORT [FOR] SEPTEMBER 1, 1952 THROUGH NOVEMBER 30, 1952. Harold E. Babbitt and E. Robert Baumann. Dec. 10, 1952. 41p. (NP-4717; Quarterly Report 1; AD-339)

The apparatus to be used in the study of coagulation effects on filtrability of surface water consists of equipment for coagulation, filtration, and water analysis. Each type of equipment is described in detail. The test procedures for coagulation and filtration are described. (J.S.R.)

5925
Illinois Univ.
EFFECT OF BODY FEED ON THE FILTRATION OF WATER THROUGH DIATOMACEOUS EARTH; DESIGN OF WATER FILTERS: FINAL REPORT. Harold E. Babbitt, E. Robert Baumann, and John I. T. Moloney. 1952. 150p. (NP-4739; ATI-171964)

Results are summarized in a study of the effect of body-feed filter aid on the filtration of surface water through diatomaceous earth. Economic aspects of adding body feed and the relationship between water quality and optimum filter operation using body feed are considered. Design of a filter unit is described. Advantages of diatomite filters over conventional rapid sand filters are summarized. A new method for measuring water filterability is proposed. Data from filter battery tests are summarized. (C.H.)

5926
Cryogenic Lab., Ohio State Univ.
COMPUTATION OF THERMODYNAMIC PROPERTIES OF GASES FROM SPECTRA. THE NO MOLECULE. Leonard Glatt, Jack Belzer, and Herrick L. Johnston. Aug. 15, 1953. 22p. (NP-4796; TR-316-10)

The spectroscopic analysis of NO has been reviewed. For the most part, the choice of vibrational and rotational constants of the various pertinent electronic states were those recommended by G. Herzberg. Some adjustments were made, however, to secure a more satisfactory fit of the vibrational-rotational levels built up from existing data, and some additional constants were computed from theoretical relations in order to give more appropriate values for the highly excited levels. The thermodynamic properties of an "ideal gas" of NO molecules were computed from 1 to 6000°K. (auth)

5927
Cryogenic Lab., Ohio State Univ.
COMPUTATION OF THERMODYNAMIC PROPERTIES OF GASES FROM SPECTRA N_2. Leonard Glatt, Jack Belzer, and Herrick L. Johnston. July 15, 1953. 21p. (NP-4824; TR-316-9)

The spectroscopic analysis of N_2 has been re-examined, using the vibrational and rotational constants recommended by G. Herzberg. When necessary to obtain a better approximation for highly excited levels, additional constants were computed from theoretical equations. The thermodynamic properties of an "ideal gas" consisting of N_2 molecules have been computed from 1 to 6000°K. (auth)

5928
University of Southern Calif.
A PROPOSED APPROACH TO THE "CHELATE EFFECT." Arthur W. Adamson. [1953] 5p. (NP-4860)

Some previous investigations relative to the entropy change accompanying the formation of complex ions and ion pairs in aqueous solution are discussed. The effect of the choice of standard states on the entropy correlations is emphasized. It is pointed out that in the "chelate" effect, in general, the higher the dentate character of the ligand, the more stable is the complex. It is suggested that while structural aspects are undoubtedly relevant, the usual "chelate" effect is largely a consequence of the arbitrary asymmetry in the usual choice of standard states. It is shown that a large measure of the apparent extra stability of chelate complexes disappears with the new choice of standard states. (L.M.T.)

5929
New Hampshire Univ.
THE THERMAL DECOMPOSITION OF COPPER(II) FLUORIDE DIHYDRATE. H. M. Haendler and C. M. Wheeler, Jr. Sept. 23, 1953. 10p. (NYO-3165)

The thermal decomposition of $CuF_2 \cdot 2H_2O$ has been studied by differential thermal analysis, x-ray diffraction, and chemical analysis. It undergoes a two-stage decomposition, forming $CuOHF \cdot CuF_2$ at 132°, followed by decomposition to the oxide and fluoride at 420°. The related basic fluoride, CuOHF, also undergoes a two-stage decomposition, first forming $CuOHF \cdot CuF_2$ at 345°. (auth)

5930
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
REACTIVITIES OF 4-SUBSTITUTED 2,6-DIMEHTYL-BENZOIC ACIDS. John D. Roberts and Clare M. Regan. [1953] 6p. (NYO-3593)

The substituent effects in 4- and 5-substituted 2-methylbenzoic acids parallel closely those obtained with benzoic acids without the 2-methyl group. One possible interpretation of the results —that the reactivity of the carboxyl group is not determined by resonance-coupling of the carboxyl group with various 4-substituents—was tested by determining the apparent ionization constants in 50% water-50% ethanol of a series of 4-substituted 2,6-dimethylbenzoic acids and their reactivities toward diphenyldiazomethane in absolute ethanol. The results seem to show that this interpretation is incorrect. (J.S.R.)

5931
Harvard Univ.
BIS-INDENYL DERIVATIVES OF IRON AND COBALT. P. L. Pauson and G. Wilkinson. Aug. 10, 1953. 10p. (NYO-6132)

Bis-indenyl derivatives of Fe and Co are made by the reaction of indenyllithium or indenylmagnesium bromide with $FeCl_3$ and cobaltic acetylacetonate, respectively. The properties of $C_{18}H_{14}Fe$ and the $C_{18}H_{14}Co^+$ ion are described briefly. (auth)

5932
Harvard Univ.
ON BIS-CYCLOPENTADIENYL COMPOUNDS OF THE TRANSITIONAL ELEMENTS. F. A. Cotton, W. E.

Moffitt, P. L. Pauson, and G. Wilkinson. Aug. 28, 1953. 50p. (NYO-6133)

The preparation and properties of bis-cyclopentadienylnickel(II) and bis-cyclopentadienylnickel(III) salts are described. The heat of formation of bis-cyclopentadienylnickel(II) from the elements is 62.8 ± 0.5 kcal. New preparations of bis-cyclopentadienylcobalt(II) and Fe(II) are reported. The electronic structures of bis-cyclopentadienyl compounds are discussed. (auth)

5933

Oak Ridge National Lab.

SCALING OF COLUMBIUM IN AIR. H. Inouye. Issued Sept. 24, 1953. 20p. (ORNL-1565)

The scaling of Nb in dry air and in air containing 18.6 mm of water vapor was determined between 400 and 1200°C. In dry air at 400°C, the oxidation proceeds by short periods of rapid oxidation followed by longer periods of slower oxidation, but after an interval of 21 hr, the rate becomes linear. The presence of water vapor greatly accelerates the linear oxidation rate. In dry air at 600°C, the oxidation rate is linear. The presence of moisture in the air reduces the oxidation rate and causes a deviation from linearity. The explanation of this is that an increased surface area results from uneven oxidation when the runs are made in dry air. Above 600°C, the presence of water vapor does not affect the oxidation; the rate is linear. Both black and white oxides were formed at these temperatures and have been identified as Nb_2O_5. Three modifications of the pentoxide were found; the temperatures at which they are stable are not necessarily those found by Brauer. Rate constants were calculated for each temperature investigated, and an Arrhenius plot was made. A straight line was obtained when the logarithm of the rate constant was plotted vs. 1/T. An inflection of the curve occurs at 900°C, which corresponds to the temperature at which the scale undergoes a modification of its form. Energies of activation were calculated to be 13,400 cal/mole between 600 and 900°C and 4350 cal/mole between 900 and 1200°C. (auth)

5934

Minnesota Univ.

INVESTIGATION OF REACTIONS OF NITROGEN OXIDES WITH THE FAST-SCANNING INFRARED SPECTROMETER. PROGRESS REPORT. George R. Cowan, Arthur R. Downie, and David L. Rotenberg. Jan. 1, 1952. 25p. (UMN/S35; AD-6520)

5935

Atomic Energy Project, Univ. of Rochester

APPARATUS FOR PLATING OUT POLONIUM FOR ANALYSIS. Robert Baxter and DeWitt Wood. Aug. 3, 1953. 9p. (UR-269)

A 24-unit plating apparatus for the recovery of Po from acid solutions is described. This apparatus uses simplified glass plating columns and a single electric motor to drive the 24 stirrers. (auth)

5936

ISOTOPE EFFECTS DURING CATALYTIC HYDROGENATIONS. William A. Bonner and Clair J. Collins. J. Am. Chem. Soc. 75, 4516-18(1953) Sept. 20.

Isotope effects during the heterogeneous catalytic reductions of labeled olefin and carbonyl groups are reported. Stilbene-α-C^{14} is reduced to bibenzyl-α-C^{14} with a 2% isotope effect using Raney Ni in benzene or Pt in ethanol. Acetophenone-α-C^{14} is reduced to 1-phenylethanol-1-C^{14} with an 11.5% isotope effect using Pt in ethanol, and with an 8% isotope effect using $LiAlH_4$ in ether. No exchange of H between stilbene-α-C^{14} and bibenzyl or between acetophenone-α-C^{14} and 1-phenylethanol or ethanol was observed under the conditions of catalytic reduction employed. (auth)

5937

HYDROGEN ISOTOPE EXCHANGE BETWEEN ANTHRACENE AND SULFURIC ACID. V. Gold and F. A. Long. J. Am. Chem. Soc. 75, 4543-47(1953) Sept. 20.

The H isotope exchange between H_2SO_4 and anthracene proceeds more rapidly at the meso-positions than at the other positions of anthracene. The kinetics of D loss from the 9-position of anthracene by the action of H_2SO_4 have been followed by experiments on the 2-phase system, CCl_4-H_2SO_4. The velocity of the exchange reaction increases steeply with acidity. Analysis of the kinetic results, based on a model of the reaction which associates the yellow color of a solution of anthracene in H_2SO_4 with a conjugate acid of anthracene in which a proton is added at a meso-position, leads to a value for the rate constant of proton loss from this conjugate acid. The rate of the proton loss decreases with acid concentration, and the rate of proton addition to anthracene appears to be insensitive to the composition of the acid in the range 84 to 90% H_2SO_4 by weight. (auth)

5938

AQUO AND CHLORO COMPLEXES OF COBALT(II) AND NICKEL(II) IN 2-OCTANOL. W. D. Beaver, L. E. Trevorrow, W. E. Estill, P. C. Yates, and T. E. Moore. J. Am. Chem. Soc. 75, 4556-60(1953) Sept. 20.

A study has been made of the extent of chloro and aquo complexing of Co^{+2} and Ni^{+2} in 2-octanol solutions. Spectrophotometry was employed to identify the complexes and to estimate their stability. Evidence for the existence of $CoCl^+$, $CoCl_2$, $CoCl_3^-$, and $CoCl_4^-$ was obtained. Results of varying the water concentration in solutions of constant Co and chloride concentration showed stoichiometric reaction of two water molecules with $CoCl_2$ leading to the formation of a monochloro complex and further reaction of approximately eleven water molecules with $CoCl^+$ leading to an aquated Co species, presumably Co^{++}_{aq}. Evidence is presented for the formation of a single unstable colored chloro complex of Ni. Both Co and Ni chlorides may be polymerized in 2-octanol. These results may be significant in regard to the separation of Co and Ni chlorides through the extraction of $CoCl_2$ by 2-octanol. (auth)

5939

HAFNIUM ALKOXIDES. D. C. Bradley, R. C. Mehrotra, and W. Wardlaw. J. Chem. Soc., 1634-6(1953) May.

The alkoxides of Hf, $Hf(OR)_4$, where R = Me, Et, Pr^i, Bu^t, and tert-amyl, have been prepared; their boiling points are lower than those of the corresponding Zr compounds. Hf tert-amyloxide has a slightly higher latent heat and entropy of vaporization and a greater molecular volume than the Zr analog. The relative volatilities of Zr and Hf alkoxides are discussed. (auth)

5940

STRUCTURAL CHEMISTRY OF THE ALKOXIDES. PART IV. NORMAL ALKOXIDES OF SILICON, TITANIUM, AND ZIRCONIUM. D. C. Bradley, R. C. Mehrotra, J. D. Swanwick, and W. Wardlaw. J. Chem. Soc., 2025-30(1953) July.

The normal alkoxides, $Ti(OC_nH_{2n+1})_4$ where n = 2, 3, 4, 5, 6, 7, and 8, and $Zr(OC_nH_{2n+1})_4$ where n = 2, 3, 4, 5, 6, and 8, have been prepared, and their molecular weights and boiling points have been measured. Molecular complexity is practically independent of chain length, while boiling points increase linearly with molecular weight. Structures for the complex alkoxides are discussed. Vapor pressures and vapor densities were measured for Zr tetraethoxide and tetraisopropoxide and it is suggested that the vaporization process is $[Zr(OR)_4]_n$ (liquid) $\rightarrow$ $nZr(OR)_4$ (vapor) and that the energy of intermolecular attraction is ~18 kcals/mole. Entropies of vaporization for the n-alkoxides of Si and Ti increase with chain length,

and this behavior is discussed in terms of molecular "entanglement" in the liquid state. (auth)

5941
THE "PROTACTINYL" ION. G. A. Welch. Nature 172, 458(1953) Sept. 5.

The charge of the Pa ion in dilute perchloric acid solution has been found to be +1 by an ion-exchange method using Pa^{233} as tracer. If Pa is a member of the actinide rare earths, its pentavalent ion should be similar to those of other members of this group. It is therefore concluded that the ion in question is protactinyl, PaO_2^+. (G.Y.)

ANALYTICAL PROCEDURES

5942
Hanford Works
THE ANALYTICAL CHEMISTRY OF AMERICIUM AND CURIUM. A. Chetham-Strode, Jr. [nd] Decl. with deletions June 15, 1953. 17p. (AECD-3559; HW-28277)

Am and Cm occur in significant amounts only among the products of nuclear bombardments. As the composition of the irradiated mixture changes through radioactive growth and decay of its constituent isotopes, the separation and determination of Am and Cm may necessitate the use of a variety of analytical methods. The most widely used method is oxidation of Pu and Np to the hexavalent state with $Ce(SO_4)_2$ and then precipitation of Am^{+3} and Cm^{+3} with HF. The AmF_3 and CmF_3 are evaporated to dryness and counted for α activity. Modifications of this method include using $Ce(ClO_4)_4$ as the oxidant and dissolution of the precipitate with zirconyl ion and reprecipitation with fluoride. Cm may be determined alone by using $H_2S_2O_8$ as an oxidant. Americium may be separated from Pu by extraction of Pu with cupferron and CCl_4. The proportional α counter and the nuclear spectrometer are the two general types of analytical instruments used in the determination of Am and Cm. (J.S.R.)

5943
Illinois Univ.
CONTENT OF HUMAN TISSUES IN ELEVEN TRACE MINERALS. PROGRESS REPORT. H. H. Mitchell. June 19, 1953. 7p. (AECU-2679)

Progress is reported in the determination of the normal levels of B, Be, Co, Ga, Hg, Po, Ra, Sr, Th, U, and Zr in human tissue. A satisfactory method for the analysis of biological material for Hg is reported. Data on distribution of Be, B, Co, and Hg in human tissue are presented. (C.H.)

5944
Los Alamos Scientific Lab.
COLLECTED RADIOCHEMICAL PROCEDURES. Jacob Kleinberg, D. P. Ames, J. W. Barnes, N. A. Bonner, W. H. Burgus, G. A. Cowan, P. B. Elkin, G. P. Ford, J. S. Gilmore, M. A. Melnick, C. O. Minkkinen, H. A. Potratz, R. J. Prestwood, J. E. Sattizahn, T. T. Shull, and C. W. Stanley. Feb. 1, 1953. 197p. (LA-1566)

The properties of the chemical elements are discussed on the basis of electronic configuration. Methods are outlined for the separation from fission product material and the determination of Be, Na, P, Ca, Sc, Cr, Fe, Co, Ni, Ce plus As, Ce, As, Rb, Y, Zr, Nb, Mo, Ru, Pd, Ag, Cd, In, Sn, Sb, Cs, Ba, Ce, Eu, W, Au, and Tl. (C.H.)

5945
Coates Chemical Labs., Louisiana State Univ.
INVESTIGATIONS OF SPOT TEST METHODS OF ANALYSIS. Philip W. West, Charles G. DeVries, William C. Hamilton, Louis J. Conrad, Theo McCoy, and Jack K. Carlton. May 5, 1952. 24p. (NP-4865; U-23310; ATI-161979)

This report consists of abstracts of published articles on spot test methods of analysis. (J.S.R.)

5946
Atomic Energy Project, Univ. of Rochester
THE ANALYTICAL CHEMISTRY OF MICRO-QUANTITIES OF BERYLLIUM. Taft Y. Toribara and Ruth E. Sherman. July 15, 1953. 25p. (UR-267)

Because of the very toxic nature of Be, sub-microgram quantities of the element are of biological importance. Colorimetric, fluorimetric, and spectrographic methods used to determine small quantities of Be are subject to interferences by other elements, necessitating a separation scheme to isolate the element before measurement. The fluorimetric method based on the interaction of Be with purified morin is the most sensitive chemical determination; it compares favorably in sensitivity with the spectrographic method. The separation of Be from bone proved to be most difficult because of the large quantity of $Ca_3(PO_4)_2$. By a method which involved precipitation, electrolysis with a Hg cathode, absorption on an ion exchange resin, and complexing with acetylacetone, it was possible to isolate completely the smallest measurable quantity of Be from all biological samples. The radioisotope Be^7 was employed in the determination of the efficiency of each step of the separation scheme. (auth)

5947
RADIOCHEMICAL MICRODETERMINATION OF CHLORINE IN LUMINESCENT ZINC SULFIDE CRYSTALS. Marguerite Bancie-Grillot and Edmond Grillot. Compt. rend. 237, 171-3(1953) July 15. (In French)

Therma-neutron activation analysis of ZnS in the 5-kw Châtillon permits determination of Cl up to a limit of 5×10^{-4} g/g of ZnS in a 5-g sample. Precision is of the order of 10% for Cl contents from 10^{-5} to 5×10^{-5} g/g, if the determination is completed within 3 hr after the end of the irradiation. The error in the nephelometric method in common use is at least 50%. (G.Y.)

5948
TITRATION OF URANIUM(IV) BY ELECTROLYTICALLY GENERATED CERIC ION. N. Howell Furman, Clark E. Bricker, and Robert V. Dilts. Anal. Chem. 25, 482-6(1953) Mar.

This investigation was undertaken to test the possibility of the coulometric titration of U with electrolytically generated $Ce(SO_4)_2$. Quadrivalent U was oxidized by excess $Fe_2(SO_4)_3$, and ceric ions were generated electrolytically to oxidize the ferrous ions produced. The entire process was carried out in an atmosphere of N. A sensitive amperometric end point was employed. A Cd amalgam reductor was effective in reducing uranyl ion to the quadrivalent state. The technique of reduction and coulometric titration gives results of good accuracy and precision in the range from a few milligrams to 5 or more micrograms. Blanks are equivalent to 1 μg but are fairly reproducible. Any substances that are reduced by the Cd amalgam and reoxidized by $Ce(SO_4)_2$ obviously interfere and must be removed. (auth)

ATOMIC WEIGHTS AND PERIODIC SYSTEMS

5949
PLACE OF THE TRANSURANIC ELEMENTS IN THE PERIODIC SYSTEM. M. Haïssinsky. Experientia 9, 117-20(1953) Mar. 15. (In French)

The distribution of the peripheral electrons in the atoms is not always sufficient in itself for the chemical characterization of the elements and their classification in the periodic system. In making this classification one ought to take into consideration principally the fundamental chemical properties, namely the maximum valency, the relative stabilities of the various oxidation states, etc. Such considerations exclude the possibility of gathering the elements

of atomic numbers 89 to 98 into a single family. A complex evolution of chemical properties is rather observed in the seventh period. It can be summarized as follows: (1) The elements from Fr to U ought to be arranged normally in the vertical groups I–VI. (2) The three following elements Np, Pu, Am have strict analogies with U and form a uranide group with it. (3) Starting with Cm, there is a predominance of valency III and the appearance of a curide group whose proprieties seem to be close to those of the lanthanides Gd, Tb, Dy,... This arrangement is in agreement with the most recent physical measurements on the electronic distribution. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5950

MECHANISM OF ADDITIVE COLORATION OF ALKALI HALIDE CRYSTALS. L. M. Shamovskii [Shamovsky], L. I. Rybakova, and M. I. Gosteva. Translated from Doklady Akad. Nauk S.S.S.R. 91, 67-70(1953). 4p. (NSF-tr-82; D-91-67)

It is shown experimentally that the position and shape of the F band and the limiting concentration of the color centers are not affected by the choice of alkali metal if the coloration process takes place in saturated vapors of that metal. Additive coloring of KCl in vapors of K, Na, Rb, and Cs is discussed. The limiting concentration of the F centers was the same despite considerable differences in the density of the saturated vapors and in the ionization potential of the metals. The concentration of the F centers was determined by the optical method from the maximum and the half-width of the F band. It was inferred that the process of additive coloring of crystals is not reversible. It was established experimentally that, after additive coloring of a crystal in the saturated vapor of a metal, a lowering of the temperature under the same experimental conditions does not result in a decrease in the initial concentration of the F centers. The possibility of the transfer of electrons at high temperature from a metal into the crystal when the two are in direct contact was examined. A discussion of the kinetics of additive coloring is presented. The rate of penetration of a colored cloud into a crystal of KCl in contact with liquid K was found to be 2.03 mm/hr at 700°, 0.87 mm/hr at 600°, and 0.48 mm/hr at 500°. When the temperature is further reduced, the rate of coloring drops sharply. The removal of the anions from the lattice, even under the influence of a high potential gradient, is an extended process. An attempt was made to explain why the same concentration is obtained in the saturated vapors of different alkali metals. It was concluded that the process of additive coloring can be used to determine the equilibrium concentration of the anion sites. During additive coloring in nonsaturated vapors of the metal the limiting concentration of the F centers will depend not only on the presence of vacant anion sites in the crystal but also on the partial pressure of the metal in the surrounding vapor and on the temperature of the salt which is being colored. A discussion of the mechanism of bleaching of additively colored crystals is given. (J.A.G.)

5951

STRUCTURE OF THE ZIRCONIUM-SILICON SYSTEM. H. Schachner, H. Nowotny, and R. Machenschalk. Monatsh. 84, 677-85(1953) Aug. 15. (In German)

The crystal structures of Zr_5Si_3 and Zr_2Si have been established. Zr_5Si_3 crystallizes in the $D8_8$ system with $a = 7.87_8$ and $c = 5.54_7$ kX. Zr_2Si is of C16 type with $a = 6.56_8$ and $c = 5.36_1$ kX. The transition from the $D8_8$ lattice to the B_8 structure is discussed. A revision in the structure given in the literature for $ZrSi_2$ is necessary according to the usual ideas of the structure of disilicides, since $ZrSi_2$ will form homogeneous mixed crystals with up to 60 mole % $TiSi_2$. (G.Y.)

5952

THE CRYSTAL STRUCTURES OF $ThSe_2$ AND Th_7Se_{12}. R. W. M. D'Eye. J. Chem. Soc., 1670-2(1953) June.

The crystal structures of $ThSe_2$ and Th_7Se_{12} have been determined from powder photographs obtained by use of Guinier-type focusing cameras. $ThSe_2$ is orthorhombic with $a = 4.411 \pm 0.002$ kX, $b = 7.595 \pm 0.002$ kX, $c = 9.046 \pm 0.002$ kX. There are four molecules per unit cell, and the space group is D_{2h}^{16}–Pmnb. Th_7Se_{12} is hexagonal with $a = 11.546 \pm 0.006$ kX, $c = 4.22 \pm 0.01$ kX. There is one molecule per unit cell and the space group is C_{6h}^2–$P6_3/m$. Both compounds are thus isostructural with their corresponding sulfides. (auth)

5953

NEUTRON-DIFFRACTION STUDY OF THE STRUCTURE OF THE A-FORM OF THE RARE EARTH SESQUIOXIDES. W. C. Koehler and E. O. Wollan. Acta Cryst. 6, 741-2 (1953) Sept. 10.

In the course of experiments on the paramagnetic scattering of neutrons by rare earth ions, neutron-diffraction data from powdered samples of La_2O_3, Pr_2O_3, and Nd_2O_3 of normal isotopic constitution and Nd_2O_3 enriched in Nd^{142}, Nd^{144}, and Nd^{146} were obtained which provide direct evidence in confirmation of the accepted structure of the hexagonal form of the rare earth sesquioxides. Structural parameters are tabulated. (G.Y.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

5954

National Bureau of Standards

A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS. ANNUAL BIBLIOGRAPHY, 1951. L. M. Brown and A. S. Friedman. Aug. 1, 1953. 112p. (NBS-2529)

A bibliography of published research on the isotopes of H and their compounds has been compiled from Chem. Abstr., Brit. Abstr., and Phys. Abstr. (Science Abstr., Sect. A) for the year 1951. Each entry in the bibliography is listed alphabetically according to its leading author and contains subject code symbols designating its content. The bibliography is supplemented by compound and subject indexes. The arrangement of the bibliography parallels that of a similar bibliography compiled by Kimball for the period 1932 to 1945, inclusive. (auth)

5955

THERMAL CONDUCTIVITY OF HEAVY WATER. F. Meyer and M. Eigen. Z. Naturforsch. a8, 500-1(1953) Aug. (In German)

The thermal conductivity of H_2O and 95% D_2O–5% H_2O was determined by a column method in which convection currents are avoided by a temperature increase from bottom to top of the column. The results are presented graphically. The thermal conductivity of D_2O is only 3% less than that of H_2O, a relatively small value compared with the difference between other thermal properties. An attempt is made to explain this anomaly. (G.Y.)

FLUORINE AND FLUORINE COMPOUNDS

5956

National Bureau of Standards

CALORIMETRIC PROPERTIES OF POLYTETRAFLUOROETHYLENE (TEFLON) FROM 0° TO 365°K. George T. Furukawa, Robert E. McCoskey, and Gerard J. King. Sept. 2, 1952. 30p. (NBS-1904; AD-1878)

The thermal properties of polytetrafluoroethylene (Teflon) samples were investigated with an adiabatic-vacuum calorimeter. The effect of the annealing and quenching processes on the heat capacity of a molded

Teflon sample was studied. The heat-capacity data were used to compute the heat capacity, enthalpy, and entropy of the polymer samples at 5° intervals from 0 to 365°K. The heat-capacity results with the molded, annealed, and quenched samples of Teflon show the possibility of a glass transformation at about 160°K. The lack of a more definite glass-transformation effect is attributed to inter- and intramolecular hindrances to configurational changes in the Teflon polymer. The existence of first-order transitions at 293 and 303°K, previously reported by Quinn, Roberts, and Work, was confirmed. (auth)

5957

PERFLUOROALKYL GRIGNARD REAGENTS. PART II. REACTION OF HEPTAFLUOROPROPYLMAGNESIUM IODIDE WITH CARBONYL COMPOUNDS, AND THE MECHANISM OF REDUCTION DURING GRIGNARD REACTIONS. R. N. Haszeldine. J. Chem. Soc., 1748-57 (1953) June.

The interaction of heptafluoropropylmagnesium iodide and acet-, prop-, and butyr-aldehyde, yields the expected secondary alcohols; with the corresponding perfluoroaldehydes the secondary perfluoroalcohol is obtained, but reduction to primary alcohol and formation of a polymer of fluoroaldehyde also occurs. Acid chlorides yield fluoroketones and tertiary alcohols; esters give tertiary alcohols, fluoroketones and, by reduction, the secondary 1-(perfluoropropyl)alkanols. Reaction of heptafluoropropylmagnesium iodide with esters of perfluoroacids forms a convenient preparation of perfluoroketones, reduction of which with $LiAlH_4$ also affords the secondary perfluoroalcohols. The current theory of Grignard reactions is supported by the addition and reduction products obtained by interaction of methyl-, ethyl-, and propylmagnesium iodide and fluoroaldehydes, -ketones, and -esters, but must be modified to explain the reduction occurring in reactions of perfluoroalkyl Grignard reagents. The influence of solvent, temperature, mode of addition, and $MgBr_2$ on the yields of addition and reduction products in reactions of certain Grignard reagents has been investigated. (auth)

5958

THE ADDITION OF FREE RADICALS TO UNSATURATED SYSTEMS. PART III. CHLOROTRIFLUOROETHYLENE. R. N. Haszeldine and B. R. Steele. J. Chem. Soc., 1592-1600(1953) May.

The direction of addition of the trifluoromethyl radical to chlorotrifluoroethylene has been established. Photochemical reaction of trifluoroiodomethane with chlorotrifluoroethylene yields only compounds of general formula $CF_3{\cdot}[C_2ClF_3]_n{\cdot}I$, the value of n depending on the ratio of reactants, with a maximum of 85% of the compounds where n = 1. The constitution of the compound with n = 1 is unambiguously shown to be exclusively $CF_3{\cdot}CF_2{\cdot}CFClI$; this contradicts Henne and Kraus's results. This compound yields perfluorohex-3-ene by intermolecular removal of iodine followed by dechlorination, and $CF_3{\cdot}CF{:}CHF$ by reduction followed by dehalogenation; mechanisms are suggested for these reactions. The compounds where n = 1 to 5 have been separated and characterized, and their constitution as $CF_3{\cdot}[CF_2{\cdot}CFCl]_n{\cdot}I$ has been proved. Polychlorotrifluorethylene (Kel-F) is thus formed by head-to-tail polymerization of chlorotrifluoroethylene. Ultra-violet and infrared spectra are presented, and their diagnostic value is discussed. (auth)

5959

THE REACTIONS OF FLUOROCARBON RADICALS. PART IX. SYNTHESIS AND REACTIONS OF PENTAFLUOROPROPIONIC ACID. R. N. Haszeldine and K. Leedham. J. Chem. Soc., 1548-52(1953) May.

Interaction of pentafluoroiodoethane and acetylene yields 3,3,4,4,4-pentafluoro-1-iodobut-1-ene, oxidized to pentafluoropropionic acid, from which the derivatives C_2F_5X [X = CO_2Na, CO_2K, CO_2AG, CO_2Me, CO_2Et, $CO{\cdot}NH_2$, CN, COCl, $CO_2{\cdot}CH{:}CH_2$, $CH_2{\cdot}OH$, CHO, $CH(OH)_2$, $CH_2{\cdot}NH_2$, $CH_2{\cdot}NCO$, and $CO{\cdot}O{\cdot}CO{\cdot}C_2F_5$] have been prepared; their infrared spectra are discussed. The decomposition of salts of perfluorocarboxylic acids under a variety of conditions is considered. (auth)

5960

THE THERMAL DECOMPOSITION OF TETRAFLUOROETHYLENE. B. Atkinson and A. B. Trenwith. J. Chem. Soc., 2082-7(1953) July.

The thermal decomposition of tetrafluoroethylene at temperatures from 300 to 800°C is described. Below 600°C dimerization to octafluorocyclobutane, and the reverse reaction, are much faster than any of the other reactions taking place. Hexafluoropropene and octafluorobutenes are formed at 600 to 800°C. At 800°C hexafluoroethane and tars are also obtained. Vapor-pressure measurements for the major products are reported. In the reaction, 2 tetrafluoroethylene $\rightleftharpoons$ octafluorocyclobutane, the rate constant for the forward reaction, between 300 and 550°C, is given by $k = 10.3 \times 10^7 e^{-25,400/RT}$ l-mole^{-1} sec^{-1} and that for the reverse reaction, between 520 and 590°C, by $k = 8.9 \times 10^{15} e^{-74,100/RT} sec^{-1}$. ΔH for the reaction at 527°C (800°K) is −50.3 kcal. (auth)

5961

REACTIONS OF FLUOROCARBON RADICALS. PART X. POLYFLUOROALKYL NITROSO- AND NITRO-COMPOUNDS. R. N. Haszeldine. J. Chem. Soc., 2075-81(1953) July.

Nitric oxide combines with the perfluoroalkyl radicals $CF_3{\cdot}[CF_2]_n{\cdot}$ produced photochemically from the corresponding perfluoroalkyl iodides, to give the intensely blue, monomeric nitroso compounds $CF_3{\cdot}[CF_2]_n{\cdot}NO$ (n = 1, 2, 3, 4, or 6). The compounds $CClF_2{\cdot}CF_2{\cdot}NO$, $CBrF_2{\cdot}CF_2{\cdot}NO$, $CBrF_2{\cdot}NO$, $CClF_2{\cdot}NO$, and $(C_2F_5)(CF_3)CF{\cdot}NO$ are similarly obtained. Oxidation of the corresponding nitroso compounds yields $CF_3{\cdot}NO_2$, $C_2F_5{\cdot}NO_2$, $C_3F_7{\cdot}NO_2$, and $CClF_2{\cdot}NO_2$. The compounds $CClF_2{\cdot}CF_2{\cdot}NO_2$, $CClF_2{\cdot}CClF{\cdot}NO_2$, and $CClF_2{\cdot}CCl_2{\cdot}NO_2$ are obtained by the reaction of nitrosyl chloride with tetrafluoroethylene, chlorotrifluoroethylene, and 1,1-dichlorodifluoroethylene, respectively; nitrosyl bromide and tetrafluoroethylene similarly yield 1-bromotetrafluoro-2-nitroethane. 1-Chlorotetrafluoro-2-nitroethane can also be obtained from tetrafluoroethylene and nitryl chloride. Nitrogen dioxide readily combines with $CClF{:}CF_2$, $CCl_2{:}CF_2$, or C_2F_4 to give the corresponding dinitro compounds. Attempts to replace the Cl or Br in $CClF_2{\cdot}NO_2$ or $CBrF_2{\cdot}CF_2{\cdot}NO_2$ by F lead mainly to C−N bond fission. (auth)

GRAPHITE

5962

Battelle Memorial Inst.

GRAPHITIZATION PROCESSES IN COKES AND CARBON BLACKS. A. E. Austin and W. A. Hedden. June 19, 1953. Decl. Aug. 21, 1953. 22p. (AECD-3588; BMI-842)

The effects of heat treatments of 2000 to 4650°F on the structure of carbons from several sources have been investigated by x-ray-diffraction techniques. Of particular interest was the effect of temperature on the degree of graphitization. The process of graphitization results in a larger graphite crystallite size in the a_0 direction, the plane of the layers, than in the c_0 direction. No correlation was found between the structure of the coke heated at 2000°F and the degree of graphitization attained at 4650°F. Materials coked in a closed retort yielded a more perfect graphite structure than the same material coked with access to air. Carbon blacks yield graphite with a greater

c_0 lattice constant than cokes with comparable crystallite sizes. (auth)

5963

FORMATION OF GRAPHITE BY CATALYTIC DECOMPOSITION OF CARBON MONOXIDE. Bernard Fleureau. Compt. rend. 237, 330-2(1953) July 27. (In French)

X-ray diffraction was used to study the carbon prepared by the reaction of CO on Fe at temperatures between 500 and 1200°C. In every case, the spectrum of graphite was observed. The velocity of formation was greatest at 500°C. By treating the graphite with Cl at 1000°C, it was possible to reduce the Fe content to <0.2%. A very pure graphite free of boron was thus obtained. Position and width of the x-ray lines indicate that the graphite had a high rate of graphitization. The mechanism of the catalytic reaction is discussed. (G.Y.)

5964

ROLE OF WATER IN THE STRUCTURE OF GRAPHITIC ACID. Rosalind E. Franklin. J. chim. phys. 50, C26(1953) July-Aug. (In French)

In dry graphitic acid, each layer of C is adjoined by two layers of O (and H). When the ambient humidity increases, either one or two monomolecular layers of H_2O become interspersed between the two layers of structural O. An x-ray-diffraction study indicates a structural continuity between the layers of adsorbed H_2O and the layers of O (and H). Graphitic acid is considered to have an ionic structure in which the cations are the simple layers of C, and the anions are the layers of composition $(O_xH_y)_n$. It is impossible to insert a third layer of H_2O, and reduction by nascent H results in immediate loss of O. (G.Y.)

5965

THE ELECTRICAL RESISTANCE OF GRAPHITE AT LOW TEMPERATURES. J. M. Reynolds, H. W. Hemstreet, and T. E. Leinhardt. Phys. Rev. 91, 1152-5(1953) Sept. 1.

The resistance of natural graphite and of high-purity polycrystalline graphite has been measured over a range of temperature from room temperature down to 1.35°K. The resistance of large-crystal natural graphite was found to increase with increasing temperature over the entire range. For polycrystalline graphite the resistance was found to increase smoothly as the temperature was lowered to about 20°K. At this temperature the resistance begins to level off until, around 5°K, it is virtually independent of temperature, at a value about double the room-temperature resistance. Below 5°K the resistance seems to fall slightly. (auth)

LABORATORIES AND EQUIPMENT

5966

Mound Lab.

APPARATUS FOR DETERMINING THE PHYSICAL PROPERTIES OF SOLUTIONS AT ELEVATED TEMPERATURES AND PRESSURES. J. R. Heiks, M. K. Barnett, L. V. Jones, and W. C. McCluggage. Jan. 14, 1953. Decl. Aug. 28, 1953. 31p. (AECD-3584; MLM-799)

Detailed descriptions are given of the apparatus designed and assembled at Mound Lab. for the investigation of the density, viscosity, surface tension, and vapor pressure of aqueous UO_2SO_4 solutions at temperatures up to 250°C and pressures up to 2,500 psi. (auth)

5967

Sterling Chemistry Lab., Yale Univ.

ADSORPTION STUDIES ON CLAY MINERALS. 3. A TORSION PENDULUM ADSORPTION BALANCE. Edmund W. Gelewitz and Henry C. Thomas. [1953] 19p. (BNL-1538)

Measurement of an adsorption isotherm of the type of interest in working with clay minerals involves direct weighing after equilibration with a definite vapor. For this weighing, a quartz-fiber torsion-pendulum balance was constructed utilizing the fact that, if the changes in the moment of inertia of the swinging element of a torsion pendulum are due solely to changes in mass, these changes in mass can be determined with precision by measurements of the period. The essential parts of the apparatus are the torsion pendulum, an optical recording system, and an oscillator timing device. A complete description is given of the apparatus including its calibration and operation. (For preceding report in series see AECU-1589.) (L.M.T.)

5968

Chemical Corps Medical Lab., Army Chemical Center

AN APPARATUS FOR THE CONTROLLED DISPERSION OF VAPORS FROM RED FUMING NITRIC ACID. Stanley B. Goldberg. Oct. 1952. 19p. (NP-4774)

In the course of investigating the inhalation toxicity of the oxides of red fuming HNO_3, the problem of maintaining constant concentrations of the two components (HNO_3 and NO_2) was encountered because of the difference in vapor pressures. A dispersion apparatus which was subsequently developed to solve this problem is described, and results showed the vapor concentrations to remain constant over a period of 4 hr when the apparatus is used. (L.M.T.)

RADIATION CHEMISTRY

5969

REMARKS ON THE MECHANISM OF X-RADIATION-CHEMICAL OXIDATION IN AQUEOUS SOLUTION. Emil Abel. Z. physik. Chem. 202, 108-16(1953) July. (In German)

A mechanism is established to explain the experimental results on the x irradiation of O-free and O-containing aqueous ferrous and ferric systems reported by Rigg, Stein, and Weiss (NSA 6-2630). The proposed mechanism avoids most of the objections to the one given by these authors. The reaction kinetics derived from the proposed mechanism is in agreement with the existence of both radicals and electrons in stationary concentration. (tr-auth)

5970

THE INDUSTRIAL FUTURE OF RADIATION CHEMISTRY. Bernard Manowitz. Nucleonics 11, No. 10, 18-20(1953) Oct.

Brief discussions are presented regarding the feasibility, potential, and economic aspects of large-scale fission-gas and mobile γ irradiators. Experimental data on the γ-initiated polymerization of eight organic compounds and the extrapolated production data are presented. (L.M.T.)

5971

OXIDATION OF FERROUS SULFATE IN SULFURIC ACID SOLUTION BY THE RADIATIONS OF RADON AND THE ACTIVE DEPOSIT. Marc Lefort. Compt. rend. 237, 159-61(1953) July 15. (In French)

Oxidation of $FeSO_4$ in 0.8N H_2SO_4 by the combined α, β, and γ radiation of dissoved Rn and its active deposit has been studied. The oxidation yield G = 7.5 for solutions saturated with air. This yield is independent of Fe concentration between 10^{-4}M and 10^{-2}M. No reduction of $Fe_2(SO_4)_3$ was observed, but H_2O_2 formed with a much greater yield than in pure H_2O (G = 1.6 instead of 0.9). In the absence of air, the oxidation yield G = 4.0. These results are in agreement with those reported previously for Po α rays if the $\beta + \gamma$ radiations absorbed by the solution are taken into account. The effect of O on the reactions is discussed. (G.Y.)

5972

RADIATION DECOMPOSITION OF CARBON-14-LABELED COMPOUNDS. Richard M. Lemmon. Nucleonics 11,

No. 10, 44-5(1953) Oct.

Self-irradiation produces much more decomposition than had been expected for several labeled organic compounds. Data to date are reported here, and methods for determining radiopurity and preventing decomposition are considered. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

5973

Ames Lab.

THE STRUCTURE OF LANTHANUM SULFATE ENNEAHYDRATE. Elton B. Hunt, Jr., R. E. Rundle, and A. J. Stosick. [Jan. 13, 1953] 31p. (ISC-277)

Lanthanum sulfate enneahydrate, $La_2(SO_4)_3 \cdot 9H_2O$, is hexagonal, $a_0 = 10.98$, $c_0 = 8.13$, $z = 2$, space group $C6_{3/m}$. There are 2 types of La ions in the structure, 2 at $000,00\frac{1}{2}$ with 12 sulfate oxygens about them at 2.72 A, 2 at $\pm \frac{1}{3}\frac{2}{3}\frac{1}{4}$ with 6 H_2O molecules and 3 sulfate oxygens at 2.6 to 2.7 A. It is presumed that the failure of the heavier rare earth sulfates to form an enneahydrate is due to their inability to support a coordination number of 12 for O. (auth)

SEPARATION PROCEDURES

5974

Sanitary Engineering Research Project, Univ. of Calif.

CONCENTRATION OF RADIOISOTOPES BY ACTIVATED SLUDGE; PROGRESS REPORT COVERING PERIOD APRIL 1, 1952 TO MAY 31, 1953. Warren J. Kaufman, Gerhard Klein, and Arnold E. Greenberg. May 31, 1953. 71p. (AECU-2665; Progress Report 2)

This investigation was made to evaluate the effectiveness of the activated sludge process for the concentration of radioisotopes from liquid wastes. The study was concerned with possible applications of biological treatment methods to the wastes of the atomic energy industry and with the role of the municipal sewage treatment plant receiving the wastes of research and medical institutions. The isotopes studied included P^{32}, I^{131}, and Sr^{89} in the chemical forms of the orthophosphate, iodide, and strontium ions respectively. With each isotope, studies were first made on a batch basis to determine the influence of variation in substrate composition as well as modifications in the operation of the treatment process. These investigations were concerned with such parameters as the concentration of carrier and chemically similar elements, the presence of complexing agents, and the nutritional characteristics of the waste as related to the concentration and activity of the organisms present in the microbiological system. Following the preliminary batch investigations, continuous flow pilot scale studies were carried out with each isotope in order to estimate the removals to be expected in the full scale activated sludge treatment plant. Radioisotopes were added continuously over a sufficient period of time for steady state conditions to be reached and for a true tracer relationship to be established between the radio-element and its carrier. Additional tests were made to determine the manner of passage of transient concentrations of radioisotopes through the treatment plant with the objective of evaluating the relative influence of hydraulic and isotopic dilution. (auth)

5975

Ames Lab.

THE SEPARATION OF RARE EARTHS BY ION-EXCHANGE. 8. QUANTITATIVE THEORY OF THE MECHANISM INVOLVED IN ELUTION BY DILUTE CITRATE SOLUTIONS. F. H. Spedding and J. E. Powell. Aug. 6, 1953. 26p. (ISC-385)

The elution of rare earths from cation-exchange resins by means of dilute citrate solutions in the pH range 5.0 to 8.0 is explained using only classical thermodynamic relationships and the concepts of electrical neutrality and material balance. The predominant ion species are discussed in detail, and the important constants for the Nd-ammonium citrate exchange system were evaluated from experimental data. Theoretical curves were constructed and compared to the actual experimental points; the agreement is excellent. (auth)

5976

Syracuse Univ.

COPRECIPITATION OF MANGANESE(II) ON BASIC STANNIC SULFATE PRECIPITATED FROM HOMOGENEOUS SOLUTION. Louis Gordon, Harry Teicher, and B. P. Burtt. Aug. 15, 1953. 30p. (NYO-3192)

A study was undertaken to determine whether precipitation from homogeneous solution could be utilized to study the distribution of a contaminant between an insoluble precipitate and its mother liquor under approximately equilibrium conditions. The results indicate that among the primary factors influencing the extent of coprecipitation of Mn(II) with basic stannic sulfate precipitated by the urea procedure are the initial concentration of Mn, the initial supersaturation, the rate of precipitation, adsorption on the surface of the completely precipitated carrier, and anomalous mixed-crystal formation. This latter effect was exhibited at low initial concentrations of Mn and was indicated by adherence to the logarithmic distribution law. The results also offer further confirmation of the advantages offered by precipitation from homogeneous solution and indicate a method for the separation of pure carriers. (auth)

5977

Radiation Lab., Univ. of Calif., Berkeley

DYNAMICS OF STAGEWISE EXTRACTION COLUMNS. T. E. Hicks, B. Rubin, and T. Vermeulen. Aug. 10, 1953. 21p. (UCRL-2295)

A calculation method has been developed in order to correlate continuous-flow extraction results in mixer-settlers with rate data for batch experiments. This correlation utilizes dynamic extraction coefficients that are calculated from the rate data and the equilibrium extraction coefficients. The dynamic coefficients may then be used in stage-by-stage calculations, or their average values used in equations derived from the over-all performance of center-fed columns. (auth)

5978

Radiation Lab., Univ. of Calif., Berkeley

SEPARATION OF IRON AND COBALT ON SYNTHETIC RESIN. Harold L. Helwig, James K. Ashikawa, Hugh Clokie, and Elmer R. Smith. Aug. 5, 1953. 6p. (UCRL-2296)

Fe and Co can be separated by fractionation on Dowex-1 resin. The Co was eluted by 5M HCl, and the Fe by 0.5M HCl. Mixtures of the two which were separated by triple extraction with isopropyl ether could be further fractionated by the Dowex-1 resin. (J.S.R.)

5979

Radiation Lab., Univ. of Calif., Berkeley

THE SEPARATION OF THE FOUR PLATINUM GROUP METALS, PALLADIUM, RHODIUM, IRIDIUM AND PLATINUM. P. C. Stevenson, A. A. Franke, R. Borg, and W. Nervik. Aug. 24, 1953. 3p. (UCRL-2329)

A mixture of Pd, Rh, Ir, and Pt may be separated by fuming with HNO_3 and $HClO_4$ to remove all traces of halide ions. The diluted solution is put into an ion-exchange column. The Pt will pass through while the other elements adhere. Pd is stripped from the column with 0.05 to 0.5M HCl; Rh with 2M HCl; and Ir with 4 to 6M HCl. (J.S.R.)

5980

STUDIES OF THE SOLVENT EXTRACTION BEHAVIOR OF THE TRANSITION ELEMENTS. II. ISOLATION OF GRAM QUANTITIES OF Th^{230} (IONIUM) FROM A PITCHBLENDE RESIDUE. D. F. Peppard, G. Asanovich, R. W. Atteberry, O. DuTemple, M. V. Gergel, A. W. Gnaedinger, G. W. Mason, V. H. Meschke, E. S. Nachtman, and I. O. Winsch. J. Am. Chem. Soc. 75, 4576-78(1953) Sept. 20.

Through utilization of differences in liquid-liquid extractive behavior among the transition elements, approximately 60 g of Th^{230} (ionium) of isotopic purity averaging 11%, a radionuclide of importance for conversion to Pa^{231} through neutron irradiation and for tracer applications, has been isolated from an aqueous solution of nitrates resulting from the processing of Belgian Congo pitchblende concentrate for U. The Th^{230} (5 g/ton of liquor) and accompanying Sc, Y, rare earths, and residual U were separated from bulk contaminants and certain radionuclides by use of one solvent system, the residual U eliminated by use of a second, and the remaining contaminants eliminated by use of a third solvent system. The mass ratio of Sc, the only massive contaminant detectable, to product Th^{230} was less than 0.001. Extraneous α activity was less than 0.002% of the total, and β-γ contamination was negligible. (auth)

SPECTROSCOPY

5981

AN OPTICAL METHOD FOR THE STUDY OF THE SILICON ORGANIC HYDROCARBONS. RAMAN SPECTRA OF ALKENYLSILANES. Yu. P. Egorov [Yegorov] and P. A. Bazhulin. Translated from Doklady Akad. Nauk S.S.S.R. 88, 647-50(1953). 4p. (NSF-tr-69; D-88-647)

Unsaturated silicon organic compounds containing the groups CH_3, C_2H_5, $CH{=}CH_2$, and $CH_2CH{=}CH_2$ attached to the Si were studied. The spectra were obtained with a ISP-51 spectrograph, and the intensity of the lines was determined by the photometric method. Data concerning the frequencies and intensities of the lines of triethylvinylsilane, trimethylallylsilane, triethylallylsilane, tripropylallylsilane, tributylallylsilane, phenyldimethylallylsilane, methyldiallylsilane, β-allylpropyltrimethylsilane, and β-allylpropyltriethylsilane are given. Results of the experiment showed a noticeable constancy of all reported frequencies and intensities within the limits of each subgroup (allylsilanes and β-allylsilanes), and that the frequency characterizing the double k bond C=C increases systematically when the double bond is removed from the silicon. Additional information is given on derived valence oscillations and the type of substitution groups in Si. (J.A.G.)

SYNTHESES

5982

Harris Research Labs.

THE CHEMISTRY AND BIOSYNTHESIS OF ISOTOPICALLY LABELED CELLULOSE. PROGRESS REPORT [FOR] FEBRUARY 1, 1952. 11p. (AECU-2632)

Radioactive cellulose was synthesized by the microörganism Acetobacter xylinum when C^{14}-labeled mannitol was used as a nutrient. Data are tabulated on the distribution of activity among the C atoms of the glucose obtained by hydrolyzing purified cellulose pellicles grown with and without added ethanol. Results of analysis of culture fractions from pellicles grown with C^{14}-ethanol and with inactive glucose indicate that only 0.5% of the total cellulose produced is derived from ethanol under these conditions. Labeled cellulose pellicles were also produced from C^{14}-glucose in the presence of inactive ethanol and without ethanol. (For preceding report in series see AECU-2654.) (C.H.)

5983

ESTERS CONTAINING PHOSPHORUS. PART XI. ETHYLPHOSPHONIC DICHLORIDE CONTAINING ^{32}P. B. C. Saunders and T. S. Worthy. J. Chem. Soc., 2115-7(1953) July.

Radioactive ethylphosphonic dichloride has been prepared on a small scale in an enclosed system by reactions not involving filtrations. Tetraethyllead converts PCl_3 into ethylphosphonous dichloride (ethyldichlorophosphine), which is then oxidized by sulfuryl chloride to the phosphonic dichloride. (G.Y.)

5984

TOXIC FLUORINE COMPOUNDS CONTAINING THE C–F LINK. PART IX. PREPARATION OF CARBON-LABELLED SODIUM FLUOROACETATE ON A MICRO-SCALE. B. C. Saunders and T. S. Worthy. J. Chem. Soc., 1929-34 (1953) June.

Pure Na fluoroacetate labeled with C^{14} in the methylene group has been prepared on a 100-mg scale. A description is given of a specially designed microautoclave suitable for microfluorination. A convenient ampoule breaker has been devised to meet the special needs of this kind of work. Radioactive Na fluoracetate is to be used to test theories of fluoroacetate poisoning. (auth)

TRACER APPLICATIONS

5985

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

REARRANGEMENT IN THE REACTION OF CHLOROBENZENE-1-C^{14} WITH POTASSIUM AMIDE. John D. Roberts, Howard E. Simmons, Jr., L. A. Carlsmith, and C. Wheaton Vaughan. [1953] 4p. (NYO-3592)

The rearrangements in the amination of "non-activated" aryl halides with alkali-metal amides disregard the influences governing the usual aromatic substitutions. The reaction of chlorobenzene-1-C^{14} with KNH_2 was used to determine a possible mechanism. An elimination-addition mechanism involving at least transitory existence of an electrically neutral "benzyne" intermediate was strongly indicated. (J.S.R.)

URANIUM AND URANIUM COMPOUNDS

5986

Mound Lab.

THE pH OF URANYL SULFATE-URANIUM TRIOXIDE SOLUTIONS. E. Orban. Aug. 14, 1952. Declassified Sept. 8, 1953. 15p. (AECD-3580; MLM-738)

Uranium trioxide will dissolve in UO_2SO_4 solution with a resulting rise in pH of more than 1.5 units in some instances. The change of pH with temperature is considerably greater in solutions with dissolved excess UO_3 than in pure UO_2SO_4 solutions. A table giving the pH of UO_2SO_4 solutions with excess of UO_3 is included. (auth)

5987

Mound Lab.

THE DENSITIES OF URANYL SULFATE SOLUTIONS BETWEEN 20° AND 90°C. J. S. Jegart, J. R. Heiks, and E. Orban. Oct. 10, 1952. Decl. with deletions Sept. 8, 1953. (AECD-3582; MLM-728)

The densities of aqueous UO_2SO_4 solutions were measured for 12 concentrations between the temperatures of 20 and 90°C. The density range at 20°C is 1.0539 g/cc at 0.17 molal to 2.0059 g/cc at 3.9 molal. (auth)

5988

Mound Lab.

THE pH MEASUREMENT OF URANYL SULFATE SOLUTIONS FROM 25° TO 60°C. Edward Orban. Aug. 1, 1952. Decl. with deletions Sept. 8, 1953. (AECD-3583; MLM-729)

The pH of uranyl sulfate solutions has been measured

from 25 to 60°C over a concentration range from 0.0006 to 3.9 molal. At 25°C the pH changes from 4.12 for the lowest concentration to 0.55 at the highest concentration; at 60°C the change is from 3.97 to –0.12 for the same concentrations, respectively. (auth)

5989

THE OXIDES OF URANIUM. PART III. THE SYSTEM UO_2-MgO-O. J. S. Anderson and K. D. B. Johnson. J. Chem. Soc., 1731-7(1953) June.

A study of the binary system UO_2-MgO by means of a high-temperature vacuum furnace and x-ray-diffraction measurements has revealed no evidence of compound formation at any temperature between 300 and 2350°C, but solid solutions of MgO and UO_2 are formed. The solubility of MgO in UO_2 to give a fluorite structure with anion vacancies is only a few moles per cent even at the highest temperatures unless extra O enters the solid-solution phase. This defect solid solution has a great affinity for O, however, and when it is allowed to take up extra O the solubility of MgO increases markedly, to as much as 25 mole %. Chemical analysis of these partially oxidized solid-solution phases shows that almost exactly one atom of O is taken up for each molecule of MgO dissolved in UO_2 to give a fluorite lattice having no vacant anion sites. The MgO phase does not dissolve detectable quantities of UO_2 under any of the conditions studied. (auth)

ENGINEERING

5990

Pesco Products Div., Borg-Warner Corp.

DESIGN OF LIQUID COOLANT PUMPS; DESIGN REPORT 22463-D2. PARTS 1 AND 2. Norman B. Dewees. Apr. 30, 1951. 113p. (NEPA-1855)

Design and theoretical data are presented for a lightweight pump to be used for Na in an operating temperature range of 705 to 1200°F at a flow rate of 1600 gpm at 950°F for a 108-psi head. Engineering requirements are summarized, and detailed theory and calculations are included. (E.S.)

AEROSOLS

5991

SMALL CHAMBER FOR STUDYING TEST ATMOSPHERES. C. J. Spiegl, L. J. Leach, K. E. Lauterbach, R. Wilson, and S. Laskin. Arch. Ind. Hyg. and Occupational Med. 8, 286-8(1953) Sept.

Details are given for the construction of a chamber for producing test atmospheres, together with some of the uses for such a chamber. The primary features are versatility and simplicity. (auth)

HEAT TRANSFER AND FLUID FLOW

5992

Knolls Atomic Power Lab.

THREE-DIMENSIONAL STUDY OF A JET PENETRATING A STREAM AT RIGHT ANGLES. J. P. Fraser. [1953] 9p. (AECU-2686)

This study sought to determine the relative importance of dynamic pressure forces and mixing to jet penetration. The comparison was accomplished indirectly by analytically calculating the distortion and deflection of the jet due to dynamic pressure forces in the first diameter of travel, extrapolating the deflection curve to permit comparison with an experimental curve of jet penetration; and inferring that jet penetration is chiefly controlled by pressure forces. (auth)

5993

Johns-Manville Corp.

THERMAL INSULATION DEVELOPMENT. FINAL REPORT. S. Speil. Sept. 14, 1953. 2p. (AECU-2688)

The development of asbestos thermal insulation for the SIR Mark A is described. (K.S.)

5994

Illinois Univ.

RESEARCH ON VISCOSITY EFFECTS ON TWO-DIMENSIONAL INCOMPRESSIBLE AND COMPRESSIBLE FLOWS THROUGH AXIAL FLOW COMPRESSORS AND TURBINES; QUARTERLY PROGRESS REPORT, JULY–OCTOBER 1952. T. Paul Torda. Oct. 7, 1952. 5p. (C-PR-2; AD-8792)

The work accomplished to date in the analysis of axial-flow machinery by the indirect (channel-flow) method is very briefly summarized. The analysis was extended to the case of finite blade spacing, and the force field assumed in the axially symmetric incompressible case involving an infinite number of blades was suppressed by the introduction of the nonsymmetric terms in the flow equations. (L.M.T.)

5995

Fluid Motion Sub-Committee, Aeronautical Research Council (Great Britain)

THEORETICAL CONSIDERATIONS ON FREE CONVECTION IN TUBES. M. J. Lighthill. July 21, 1952. 44p. (FM-1758)

5996

Institute of Engineering Research, Univ. of Calif., Berkeley

GENERALIZED THEORY OF CONVECTIVE HEAT TRANSFER IN A FREE-MOLECULE FLOW. A. K. Oppenheim. Mar. 18, 1952. 27p. (HE-150-93; ATI-158453)

The theory of the convective heat transfer in a free-molecule flow with Maxwellian velocity distribution is generalized by reducing all the relationships to a form common to all gases irrespective of their molecule structure. The heat-transfer characteristics of simple surfaces consisting of a flat plate in the direction of flow, a flat plate normal to flow, a transverse cylinder, and a sphere have been computed and correlated. A simple method is outlined for extrapolation of the results to a flat plate at any angle of incidence, a wedge or a cone, and for the evaluation of heat-transfer parameters for a compound surface. The effect of shape on convective heat-transfer characteristics was small. At low Mach (M) numbers the Stanton number of all shapes approaches the value of $\gamma + 1/\gamma \cdot \alpha/4\sqrt{\pi S}$, where γ equals the ratio of the specific heat, S equals the surface area of the body, and α equals the accommodation coefficient. The difference between various shapes becomes more distinct at high Mach numbers. For $M > 2$, the magnitude of the Stanton number did not exceed the value of $(\gamma + 1/2\gamma)\alpha$. The effect of shape on the recovery factor is more distinct at low Mach numbers and becomes hardly noticeable for Mach numbers higher than 5. For the temperature ratio, T_{aw}/T_0 (T_{aw} equals the adiabatic wall temperature and T_0 equals the free stream temperature), this effect is small for both low and high Mach numbers and is most noticeably in the vicinity of Mach number unity. (auth)

5997

Knolls Atomic Power Lab.

EVALUATION OF TRANSIENT TEMPERATURES AND STRESSES. R. J. Fritz. July 27, 1953. 51p. (KAPL-951)

Solutions to the one-dimensional, heat-conduction equation for arbitrary surface temperature transients are treated by superposition of other solutions and by a concept of thermal

reflections. The maximum thermal stresses are given for a flat plate due to a given surface temperature change at a linear rate. Thermal stresses in thin cylindrical shells are discussed, and an example is evaluated. Design factors are discussed briefly, mainly by citing critical problems and giving references. A comprehensive bibliography is presented. (auth)

5998

Stanford Univ.

BASIC HEAT TRANSFER AND FLOW FRICTION DESIGN DATA FOR GAS FLOW TO BANKS OF STAGGERED TUBES: USE OF A TRANSIENT TECHNIQUE. W. M. Kays and R. K. Lo. Aug. 15, 1952. 104p. (NP-4857; Technical Report 15)

Both the heat transfer and flow friction of six staggered tube patterns are considered. By the transient technique the heat transfer of what amounts to a tube bank of indefinite extent in all directions is determined, and, in addition, the performance of individual tube rows near the entrance and exit of the heat-exchanger core have also been obtained. The Reynolds number test range (Re based on hydraulic diameter) is approximately 500 to 10,000, entirely in the range of turbulent tube bank flow but extending somewhat below the previously available data. The test results indicate that the transient technique is applicable with good accuracy to the determination of the characteristics of staggered tube banks, yielding substantially the same performance characteristics as steady-state methods. Since, however, it is also possible to determine the performance of individual tubes, this technique provides a very powerful experimental tool. It has been found, for instance, that the heat exchanger entrance materially affects the heat transfer performance of the tubes for only the first 3 or 4 rows and that the effect previously noted (by steady-state methods) for as many as 10 rows is merely the integrated effect of the first few rows. In general, both the heat transfer presented in the form $StPr^{2/3}$ vs. Re_f, and the friction presented as f versus Re_f, are found to lie 15 to 20% below the Grimison curves. The heat transfer is actually better represented by the Colburn equation for flow over banks of staggered tubes. No simple method of algebraically representing the effects of geometrical pattern on $StPr^{2/3}$ and f was found, so a graphical interpolation method is proposed. (For preceding report in series see NP-4309.) (auth)

5999

Stanford Univ.

HEAT TRANSFER AND FLOW FRICTION CHARACTERISTICS OF POROUS MEDIA. J. E. Coppage. Dec. 1, 1952. 77p. (NP-4858; Technical Report 16)

Convective heat transfer and flow-friction data are presented for the flow of air through wire screen matrices and sphere matrices. The range of Reynolds numbers covered, based on a hydraulic diameter, was from about 5 to 1000. The data were obtained principally for closely packed wire screens, covering a range of porosities from 0.60 to 0.83; data were also obtained for one separated screen matrix. The data for spheres were obtained for one randomly packed condition, the porosity being 0.39. Based on the results of these experiments an empirical correlation of the heat transfer data is derived that covers the range of porosities from 39 to 83%. It is also shown that the results of previous investigators fit into this correlation quite well (±25%). The flow-friction data of both present and previous investigations is shown to fall into a ±50% band using a single correlation, but this spread is too broad for technical usefulness. This band width of the flow-friction data is found to be appreciably reduced when the porous media are divided into two classifications: (1) matrices composed of bodies having holes through them, and (2) matrices composed of aggregates of solid bodies with voids between; the resulting band widths for these two correlations are then ±35% for each class. (auth)

6000

A CERTAIN PROBLEM IN HEAT CONDUCTION. Henry Zatzkis. J. Appl. Phys. 24, 895-6(1953) July.

A homogeneous sphere is surrounded by an infinite homogeneous medium. Heat is generated inside the sphere at a prescribed rate. The temperature distribution inside and outside the sphere is computed. (auth)

6001

VELOCITY PROFILE IN HIGH-VELOCITY AIR FLOW IN A CYLINDRICAL TUBE. Lucien Santon and Roger Depassel. Compt. rend. 237, 376-8(1953) Aug. 3. (In French)

Velocity profiles for subsonic air flow in a 66-mm-diameter, 5.30-m-long tube are presented graphically. (G.Y.)

6002

HIGH-VELOCITY AIR FLOW IN A CYLINDRICAL TUBE. Lucien Santon and Roger Depassel. Compt. rend. 237, 422-4(1953) Aug. 10. (In French)

Experimental relations between specific mass, static pressure, temperatures, and coefficient of friction for subsonic air flow in a 66-mm-diameter, 5.30-m-long tube are compared with existing theories. (G.Y.)

MATERIALS TESTING

6003

Pitman-Dunn Labs., Frankford Arsenal

USE OF A PORTABLE ROCKWELL HARDNESS TESTER AND EXAMINATION OF TEST RESULTS ON STANDARD CALIBRATION BLOCKS. M. A. Dougherty and W. L. Boyer. Feb. 1952. 10p. (MR-496; ATI-156112)

An investigation was conducted to determine the accuracy of a portable hardness tester in two sizes for the use of Army Ordnance field inspectors. From tests conducted on standard calibration blocks, two operators reported values determined with a Model 1 and Model 4 portable tester in two test positions and a standard Rockwell hand-operated machine. Accepting the tolerances placed on the calibration blocks by the block manufacturer as control limits, it was determined that portable machine tests were within ±1.0 hardness number on the Rockwell C scale and ±2.5 numbers on the Rockwell B scale. It is recommended that Rockwell B tests made on the portable testers, which indicate the rejection of a component within ±2.5 hardness numbers, be verified with a standard Rockwell hardness tester. (auth)

VACUUM SYSTEMS

6004

Mound Lab.

A METAL HIGH-VACUUM MANIFOLD. E. Paige. Feb. 17, 1953. 13p. (MLM-810)

A metal manifold for vacuum-system application was constructed from hard, drawn-Cu pipe and 6 Veeco Type R angle valves. The large bore of these valves was an important factor in the speed with which the manifold could be evacuated. A pressure of 4.6×10^{-5} mm Hg was reached after 30 min of evacuation, and a pressure of 4.6×10^{-6} mm Hg, the best vacuum obtained, was reached after 36 hr of evacuation. Leakage into the static manifold was slight. In 3 hr without evacuation, the pressure in the manifold rose only from 4.0×10^{-5} to 9.0×10^{-4} mm Hg. Degassing from the metal surfaces was not a serious problem. The manifold has the advantages of durability, ease of operation, elimination of greases, and simplicity in maintenance. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

6005
Naval Research Lab.
THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS; PROGRESS REPORT FOR [PERIOD] MAY 1 TO AUGUST 1, 1953. D. D. Williams and C. T. Ewing. Aug. 12, 1953. 10p. (NRL-Memo-197; Progress Report 6)

The previously reported reaction mechanism for the NaOH-Ni reaction is confirmed. Relative diffusion rate studies for H_2 through Ni were continued, and the results show that there was no appreciable error by diffusion in the NaOH-Ni equilibrium pressures reported previously. Electrical conductivity studies with NaOH were continued. The radial apparatus which will be used for measuring the thermal conductivity of the low-conducting salts is described in detail. (For preceding period see NRL-Memo-170.) (auth)

CERAMICS AND REFRACTORIES

6006
Ceramic Lab., Pass and Seymour, Inc.
CERAMIC DENSE ZIRCON LOW-LOSS MATERIAL; FINAL REPORT, DECEMBER 1, 1950–JUNE 25, 1952. F. P. Hall. June 25, 1952. 26p. (NP-4805; ATI-157933)

Pilot plant scale production of ceramic dense zircon low-loss bodies has been demonstrated. Body No. 18 has been modified for use in production in ceramic plants equipped with modern facilities. A body (1841) has been developed for Cone 12 firing, and a body 1861A has been developed for cone 10 to 11 firing. These bodies are applicable for production in the modern ceramic plants. (auth)

CORROSION

6007
Hanford Works
THE POTENTIAL–pH DIAGRAM FOR ALUMINUM. C. Groot and R. M. Peekema. Aug. 17, 1953. 14p. (HW-28556)

Thermodynamic data for Al are summarized in the form of a potential-pH diagram. This diagram shows correctly what combinations of potential and pH would result in acidic corrosion, film protection, caustic corrosion, and cathodic protection. It does not predict correctly the observed electrode potentials in aqueous solutions. (auth)

6008
Rock Island Arsenal Lab.
COMPARISON OF RUST PROTECTIVE QUALITIES OF VARIOUS MATERIALS ON BARE STEEL, OXIDE BLACKENED, AND PARKERIZED SURFACES. H. Faigen. July 8, 1942. 9p. (NP-4836; AD-162)

A study was made of the rust-protective qualities of mineral and lubricating oils and rust-preventive compounds on bare steel, oxide black, and Parkerized test panels. It was observed that black oxide coatings provided a slight but definite advantage over bare steel in regard to rate of corrosion in accelerated rusting tests. Parkerized coatings provided superior protection, and rust-preventive materials containing corrosive inhibitors gave greatly increased protection over a noninhibited oil. (J.E.D.)

GEOLOGY AND MINERALOGY

6009
Wisconsin Univ.
CORRELATION OF SOME PENNSYLVANIAN LIMESTONES OF THE MID-CONTINENT BY THERMOLUMINESCENCE; FINAL REPORT. Robert E. Bergstrom. Mar. 1953. 47p. (AECU-2672)

Thermoluminescence and related studies were made on 25 different limestones of Pennsylvanian age which were collected in Iowa, Missouri, and Kansas where detailed field studies have established rather precise correlations of many of the thin, persistent cyclical units. Each limestone was studied to determine the relative lateral persistence of its thermoluminescence characteristics on a short-range and county-wide basis. In addition, thermoluminescence variations in vertical sections were examined to determine the possibility of establishing zonations based on thermoluminescence. Supplementary insoluble residue, relative limestone transparency, and radioactivity studies were made on the limestones to increase the precision of the thermoluminescence measurements. The research indicates that the Pennsylvanian limestones of the Mid-Continent differ widely in the lateral persistence of their thermoluminescence characteristics. The most uniform "glow curves" are obtained from the pure off-shore types of marine limestones in which there are no marked lithologic changes laterally. Thermoluminescence characteristics are modified by lithologic changes, especially when the insoluble content of the limestone rises above 15 to 20%. It is concluded that thermoluminescence can be an aid in stratigraphic correlation when it is used within certain limitations, including the following: (1) when closely spaced lateral sections of closely spaced vertical samples are studied; (2) when vertical sequences of thermoluminescence variations are combined with the use of persistent "marker glow curves" wherever they occur; (3) when the limestones being studied do not undergo marked, sudden lithologic changes or pass into high-clastic facies; (4) when thermoluminescence is employed in conjunction with other correlation tools. (auth)

6010
Geological Survey
STRATIGRAPHIC SECTIONS OF THE PHOSPHORIA FORMATION IN MONTANA, 1948. M. R. Klepper, F. S. Honkala, O. A. Payne, and E. T. Ruppel. 1953. 41p. (GS-C-260)

The Phosphoria formation in southwestern Montana consists in general of 5 members, 2 phosphatic shale members and 3 hard members. The lower 2 hard members are dominated by limestone, the top member by chert and sandstone or quartzite. Most of the members can be identified over a large part of the area of outcrop, although correlation toward the east and northeast is difficult. The formation ranges in thickness from less than 100 ft to more than 800 ft. Analytical data and abstracts of stratigraphic sections measured at 20 localities are tabulated. Their locations as well as those of other sections previously reported and sections to be reported later are given. (auth)

6011
Geological Survey
RESULTS OF RECONNAISSANCE FOR RADIOACTIVE MINERALS IN PARTS OF THE ALMA DISTRICT, PARK COUNTY, COLORADO. Charles T. Pierson and Q. D. Singewald. 1953. 12p. (GS-C-294)

Pitchblende in the Alma mining district is associated with Tertiary veins of three different geologic environments: veins in pre-Cambrian rocks, the London vein system in the footwall block of the London fault, and veins in a mineralized area east of the Cooper Gulch fault. Pitchblende is probably not associated with Ag-Pb replacement deposits in dolomite. Secondary U minerals, as yet undetermined, are associated with pitchblende on two London vein system mine dumps and occur in oxidized vein

material from dumps of mines in the other environments. Although none of the known occurrences is of commercial importance, the Alma district is considered a moderately favorable area in which to prospect for U ore because 24 of the 43 localities examined show anomalous radioactivity; samples from anomalously radioactive localities, which include mine dumps and some underground workings, have U contents ranging from 0.001 to 1.66%. (auth)

6012

Columbia Univ.

PROGRESS REPORT FOR JUNE 15 TO DECEMBER 15, 1952. PART 1. FRACTURE PATTERN OF THE ZUNI UPLIFT. Arthur K. Gilkey. PART 2. FRACTURE STUDIES OF THE LUCERO UPLIFT. Robert W. Duschatko. Jan. 1953. 26p. (RME-3024)

Further information regarding the shape and fracture pattern of the Zuni uplift was compiled from drill logs, plane table maps, and low altitude aerial photographs. The fracture pattern was compared with that of three small uplifts of known origin and the critical resemblance noted. Studies were made to gather and interpret data on the pattern, spacing, and nature of fractures; on the interrelationship of fractures of different magnitudes; and on the regional tectonic history in the Lucero uplift. (J.E.D.)

6013

Utah Univ.

RELATION OF SEDIMENTARY FEATURES OF THE SALT WASH SANDSTONE TO TECTONIC ELEMENTS AND URANIUM MINERALIZATION. PROGRESS REPORT, APRIL 1, 1953 TO SEPTEMBER 1, 1953. William Lee Stokes. Sept. 12, 1953. 5p. (RME-3058)

During the period laboratory work consisted mainly of sedimentary analysis of Salt Wash sandstones. Field work consisted of study of sedimentary trends and ore deposits in the Blanding, Utah, area, study of sedimentary trends and ore deposits in the northeastern San Rafael area, and consultation and field conferences with geologists at five A.E.C. camps on local problems involving ore-bearing rocks. The detailed mapping clearly indicates that organic material is highly favorable if not absolutely essential, to ore formation. Furthermore, it appears that radical shifts in stream channels are favorable for organic accumulation and hence for ore deposition. A thorough study of stream trends in the Blanding and San Rafael districts gives the first real explanation for the distribution and relative magnitude of the known ore bodies and offers usable information for locating proposed new drill holes. Work which is in progress has added to the evidence that tectonic elements have exercised an influence on Salt Wash streams and may have brought about the shifts in direction and changes in sedimentation which indirectly caused the formation of ore deposits. (For preceding period see RME-3043 (pt.1).) (auth)

6014

Division of Raw Materials, AEC

URANIUM POSSIBILITIES IN THE PHILIPPINE ISLANDS. Edward K. Judd, Helen E. DeSanctis, and Jean C. Brown. Issued July 1953. 31p. (RME-4014)

Data drawn from many accounts issued by Philippine geologists and mining engineers in official government publications and in those of scientific and technical societies are reported. It is indicated that the best prospects for U seem to be in basement rocks, near acidic intrusions, in the vicinity of tertiary eruptive rocks and in bituminous materials. The Philippines abound in such intrusives, and the fact that these have yielded ore deposits of Au-Ag and Cu, usually in sulfides, is a favorable indication of the existence of U deposits. Potentially uraniferous lode mines in various parts of the islands are reported. (J.E.D.)

6015

Division of Raw Materials, AEC

RECONNAISSANCE AND INVESTIGATIONAL DRILLING ON HOSKINNINI AND NOKAI MESAS, SAN JUAN COUNTY, UTAH, AND NAVAJO COUNTY, ARIZONA. C. Clare Gregg. Nov. 3, 1952. 10p. (RMO-987)

An investigational drilling program was conducted to determine if the Copper Canyon channels were mineralized and to support a seismic investigation on Nokai Mesa. The results from 14 holes drilled on Hoskinnini Mesa with a total footage of 2,018 ft and 39 holes drilled on Nokai Mesa with a total footage of 5,567 ft indicate that these areas do not contain sufficient mineralization to justify further work. (auth)

6016

Geological Survey

RECONNAISSANCE FOR RADIOACTIVE DEPOSITS IN THE EAGLE-NATION AREA, EAST-CENTRAL ALASKA, 1948. Helmuth Wedow, Jr. Aug. 1953. 27p., 1 illus. (TEI-56)

Data on the radioactivity of the various types of material tested in the Eagle-Nation area in 1948 are summarized. The only rocks exhibiting abnormal radioactivity were black shale beds in the Upper Mississippian Calico Bluff formation and granitic rocks of possible Mesozoic age and their Tertiary sedimentary derivatives. Although the radioactive Carboniferous black shale is somewhat comparable in U content to similar deposits in continental United States, the grade and areal extent of the radioactive beds are not sufficient to warrant further interest except from an academic standpoint. The location of these deposits in a relatively remote part of Alaska also lessens the desirability of additional consideration. The above factors also apply to the radioactive granitic materials found in the Eagle-Nation area. (auth)

6017

Geological Survey

RED ROCK VALLEY SW, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-422)

6018

Geological Survey

DINNE MESA NE, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-423)

6019

Geological Survey

DINNE MESA SE, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. August 1952. 2p., 1 illus. (TEM-424)

6020

Geological Survey

PASTORA PEAK NE, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA AND NORTHWESTERN NEW MEXICO. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-425)

6021

Geological Survey

PASTORA PEAK NW, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-426)

6022

Geological Survey

PASTORA PEAK SE, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTH-

EASTERN ARIZONA AND NORTHWESTERN NEW MEXICO. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-427)

6023
Geological Survey
PASTORA PEAK SW, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. Aug. 1952. 2p., 1 illus. (TEM-428)

6024
Geological Survey
LOS GIGANTES SW, PRELIMINARY GEOLOGIC MAP OF PART OF THE CARRIZO MOUNTAINS AREA, NORTHEASTERN ARIZONA. J. D. Strobell, Jr. Aug. 1952. 3p., 1 illus. (TEM-430)

6025
INVESTIGATION OF THUCHOLITE. G. L. Barthauer, C. L. Rulfs, and D. W. Pearce. Am. Mineralogist 38, 802-14(1953) Sept.–Oct.

The rather unusual mineral thucholite contains about 50% C, 25% volatile gases, and 25% ash. The ash commonly consists of thoria, rare-earth oxides, and U oxide. A purified specimen (i.e., freed from contaminating uraninite) from Ontario, Canada, was subjected to a complete chemical analysis of the ash (including a resolution of certain individual rare earths) and two types of analyses on the volatile gas constituents. The thoria content in this specimen was less than 1% of the ash, in sharp contrast with the higher percentages which have been reported in previous samples. The rare-earth fraction contained a singularly high proportion, over 50%, of Y oxide. The ash was 53% U_3O_8. (G.Y.)

METALS AND METALLURGY

6026
Engineering Research Inst., Univ. of Mich.
DEVELOPMENT OF PROCEDURES FOR THE IDENTIFICATION OF MINOR PHASES IN HEAT-RESISTANT ALLOYS BY ELECTRON DIFFRACTION. PROGRESS REPORT, APRIL 15 TO JULY 15, 1952. L. O. Brockway and W. C. Bigelow. 19p. (AD-475; Progress Report 2)

The work during the period covered by this report has been devoted primarily to 16-25-6 and S816 alloys. Studies have been made to develop polishing and etching procedures for use in preparing samples of each of these alloys for study by electron diffraction methods. Electron diffraction patterns have been obtained from minor phase materials in samples of 16-25-6 alloy aged for periods of 1 to 1000-hr at temperatures of 1400 and 1600°F. These results indicate that the development of the minor phases in this alloy proceeds in two stages: (a) the formation of an $M_{23}C_6$ phase during the first few hours of aging, and (b) the transformation of this phase to an M_6C phase as aging progresses. Preliminary electron diffraction results have identified a NbC-NbN phase in several differently aged samples of S816 alloy. In addition, indications of an $M_{23}C_6$ phase in this alloy have been obtained. (auth)

6027
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT FOR JANUARY 1949. W. O. DiPietro and G. R. Findlay. Feb. 10, 1949. Decl. Sept. 22, 1953. 5p. (AECD-3561; NR-7)

6028
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT FOR FEBRUARY 1949. W. O. DiPietro and G. R. Findlay. Mar. 15, 1949. Decl. Sept. 22, 1953. 10p. (AECD-3562; NR-8)

6029
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT FOR MARCH 1949. W. O. DiPietro, G. R. Findlay, and G. L. Mellen. May 5, 1949. Decl. Sept. 22, 1953. 7p. (AECD-3563; NR-9)

6030
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT FOR APRIL 1949. W. O. DiPietro, G. R. Findlay, and G. L. Mellen. May 13, 1949. Decl. Sept. 22, 1953. 7p. (AECD-3564; NR-10)

6031
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT [FOR] MAY 1949. W. O. DiPietro, G. R. Findlay, and G. L. Mellen. July 8, 1949. Decl. Sept. 22, 1953. 14p. (AECD-3565; NR-11)

6032
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT [FOR] JUNE 1949. W. O. DiPietro, G. R. Findlay, and G. L. Mellen. July 26, 1949. Decl. Sept. 22, 1953. 8p. (AECD-3566; NR-12)

6033
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT [FOR] JULY 1949. W. O. DiPietro, G. R. Findlay, and G. L. Mellen. Aug. 10, 1949. Decl. Sept. 22, 1953. 25p. (AECD-3567; NR-13)

6034
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT [FOR] AUGUST 1949. W. O. DiPietro, G. R. Findlay, and G. L. Mellen. Sept. 9, 1949. Decl. Sept. 22, 1953. 7p. (AECD-3568; NR-15)

6035
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. SUMMARY OF THERMODYNAMIC DATA. G. R. Findlay. Sept. 16, 1949. Decl. Sept. 22, 1953. 11p. (AECD-3569; NR-16)

6036
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT [FOR] SEPTEMBER 1949. W. O. DiPietro, G. R. Findlay, and R. A. Stauffer. Oct. 10, 1949. Decl. Sept. 22, 1953. 11p. (AECD-3570; NR-17)

6037
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT FOR OCTOBER 1949. W. O. DiPietro, G. R. Findlay, and R. A. Stauffer. Nov. 10, 1949. Decl. Sept. 22, 1953. 8p. (AECD-3571; NR-18)

6038
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT FOR NOVEMBER 1949. W. O. DiPietro, G. R. Findlay, and R. A. Stauffer. Dec. 10, 1949. Decl. Sept. 22, 1953. 5p. (AECD-3572; NR-19)

6039
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT FOR DECEMBER 1949. W. O. DiPietro, G. R. Findlay, and R. A. Stauffer. Jan. 10, 1950. Decl. Sept. 22, 1953. 10p. (AECD-3573; NR-20)

6040
National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT FOR JANUARY 1950. W. O. DiPietro, G. R.

Findlay, and J. H. Moore. Feb. 10, 1950. Decl. Sept. 22, 1953. 8p. (AECD-3574; NR-21)

6041

National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. STATUS REPORT FOR FEBRUARY 20, 1950. W. O. DiPietro, G. R. Findlay, and J. H. Moore. Feb. 21, 1950. Decl. Sept. 22, 1953. 24p. (AECD-3575; NR-22)

6042

National Research Corp.
PREPARATION OF DUCTILE ZIRCONIUM. PROGRESS REPORT FOR FEBRUARY 1950. W. O. DiPietro, G. R. Findlay, and J. H. Moore. Mar. 10, 1950. Decl. Sept. 22, 1953. 12p. (AECD-3576; NR-23)

6043

Metals Research Lab., Case Inst. of Tech.
AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. QUARTERLY STATUS REPORT, JUNE 2 TO SEPTEMBER 2, 1953. W. M. Baldwin, Jr., N. J. Garibotti, and E. B. Evans. Sept. 20, 1953. 5p. (AECU-2676; Quarterly Status Report 1)

The nature and cause of the high-temperature scaling and dimensional stability of Zr are being investigated. The samples, sheared off from a cold-rolled strip, were swabbed in dilute H_2SO_4 and rinsed with water and acetone. They were suspended in vertical tube furnaces, and the increase in weight was determined as a function of time. It appeared that the scale appearance and color was temperature-dependent. In the range from 800 to 950°C the weight vs. time curve rose sharply. The plot of the parabolic scaling constant vs. the absolute temperature reciprocal had a break between the high and low temperatures which was reflected in the appearance of the scales. (J.S.R.)

6044

Knolls Atomic Power Lab.
ON THE USE OF RADIOACTIVE TRACERS FOR TAGGING SPECIAL MELTS OF STEEL. David L. Douglas. [1953] 13p. (AECU-2690)

As the inspection and analysis of special melts of alloy steel are quite expensive, the use of radioactive tracers in the melt has been suggested as an alternative check method. The selection of the nature and amount of the radioactive tracer used is limited by the following considerations: the type of radiation, the availability, the metallurgical properties, and the half life of the isotope. As Ta^{182} meets all of the requirements, tests using Ta^{182} were carried out to determine the lowest specific activity required for easy tracing and the dose rate to be expected in the neighborhood of a large accumulation of the tagged metal. It was concluded that it was feasible and safe to employ radioactive tracers in amounts of the order of 1 mc/ton for the tagging of special melts. (J.S.R.)

6045

Commonwealth Engineering Co. of Ohio
GAS PLATED COATINGS ON METALS AND ALLOYS. PROGRESS REPORT. Apr. 14, 1953. 17p. (AECU-2698; Progress Report 2)

Cr was plated on Cu bars by the passage of Cr carbonyl gas over the heated Cu. Plating conditions were varied, and the coatings obtained were, in most cases, heavy and uniform. Preparations were made for plating coatings of Ni-Cr alloys. Apparatus was installed to introduce Ni carbonyl into the plating chamber. A series of experiments were made of plating Ni on Cu bars. Uniform coatings of ductile Ni were readily obtained under vacuum operation; however, it was difficult to build up coating thickness at 800°F. At 350°F coating-thickness build-up was very satisfactory. (auth)

6046

Commonwealth Engineering Co. of Ohio
GAS PLATED COATINGS ON METALS AND ALLOYS. PROGRESS REPORT. May 11, 1953. 16p. (AECU-2699; Progress Report 3)

The objective of the work done during the month of April has been the study of coatings of Cr and Cr-Ni alloys on Cu by the gas-plating process. Three groups of experiments were performed for a total of 37 runs. In the first group Cr was plated alone. In the second group Ni was plated alone. The information obtained in these tests was used in the third group for plating alternate coats of Ni and Cr to form alloys. The alloy coatings were tested in a laboratory muffle furnace at 1550°F to determine their resistance to oxidation. Several coatings were unchanged after 32 hr in the oven. The results of these tests indicate that the ratio of Ni to Cr must be high enough to avoid cracking of the coating. The results of the x-ray and chemical analytical testing have been inconclusive because of the complex nature of the coatings. Adhesion of the deposits to the Cu surface was studied by a method consisting of reduction in H at elevated temperature followed by cooling down in an atmosphere of Ni carbonyl. (For preceding period see AECU-2698.) (auth)

6047

Research Foundation, Ohio State Univ.
MATERIALS FOR HANDLING FUMING NITRIC ACID. PART 2. PROPERTIES OF FUMING NITRIC ACID WITH REFERENCE TO ITS THERMAL STABILITY. Mars G. Fontana. Nov. 1952. 112p. (AF-TR-6519(pt.2); AD-6457)

Corrosion tests were conducted on several metals and alloys in white and red fuming HNO_3 at room temperature, 122, and 160°F. Ti, Ti-base alloys Ti-150A and RC-130-B, Zr, and Haynes 25 alloy (L-605) were found very resistant to fuming HNO_3 at all temperatures tested. Al and some of its alloys show very good corrosion resistance to FNA. Durimet-20 has fair resistance to FNA at 160°F. Stainless steels in the AISI 300 and 400 series lose their corrosion resistances to FNA when the testing temperature is increased to 160°F. The nature and mechanism of knife-line attack is discussed in detail. Results of stress corrosion of Type 347 stainless steel, effect of additives to WFNA, and galvanic couple systems are reported. The preparation of pure HNO_3 and the apparatus and experimental procedure for measuring the rate of decomposition and equilibrium decomposition pressure of HNO_3 are described. During the measurements the HNO_3 is confined over an inert fluorinated hydrocarbon oil in a glass tube. Pressures developed by the decomposition products of HNO_3 can be measured accurately from near atmospheric pressure to 2000 psi, over a wide range of temperatures and V/L ratios. Some results of tests carried out at 167°F to check the performance of the apparatus are given which show the general relations between the decomposition pressure, composition, and V/L ratio. (auth)

6048

Brown Univ. Graduate Div. of Applied Mathematics
INSTRUMENTATION AND FUNDAMENTAL EXPERIMENTS IN PLASTICITY. D. C. Drucker and F. D. Stockton. June 1952. 60p. (ATI-162676; U-23187; Technical Report 68)

The behavior of thin-walled Al-alloy tubes in the plastic range was investigated. A large mechanical extensometer of high accuracy performed successfully in this range. At a given stage of loading, the ratios of the plastic-strain increments were independent of the ratios of the stress increments. In the plastic range, when plastic strains were large compared to elastic strains, measurement of the strain increments determined the existing state of stress

and not the individual increments. When plastic and elastic strains were comparable, the stress-strain relation could be solved for the stress increments, but the accuracy was poor. (TID-LC)

6049

Battelle Memorial Inst.

WELDING AND BRAZING OF BERYLLIUM TO ITSELF AND TO OTHER METALS. R. E. Monroe, D. C. Martin, and C. B. Voldrich. May 28, 1953. 38p. (BMI-836)

Welding and brazing techniques for joining QMV Be to itself and to several other metals have been studied. Specific joining problems were studied, but the data collected are applicable to many of the design problems in which Be must be joined to itself or another metal. The inert-gas-shielded consumable-electrode welding process and Al-alloy filler metals can be used to join Be plate to other Be plate or Al plate. Cracking of the Be may prevent welding of highly restrained joints. Furnace brazing in vacuum or protective atmospheres can be used to join Be to itself and to Cu, monel, Ni, and stainless steel. Monel is the easiest of these metals to braze to Be. Al alloys, Ag, and the Ag-Cu eutectic alloy can be used as brazing materials. (auth)

6050

Battelle Memorial Inst.

EFFECT OF HYDROGEN ON MECHANICAL PROPERTIES OF ZIRCONIUM AND ITS TIN ALLOYS. G. T. Muehlenkamp and A. D. Schwope. June 30, 1953. 16p. (BMI-845)

H, in excess of 20 ppm, in Zr and its Sn alloys makes these materials behave in a brittle manner in the room-temperature notched-bar impact test. Increasing H contents, up to 500 ppm, increase the transition temperature. It lowers the tensile ductility slightly and has no apparent effect on the tensile-strength properties. The embrittling effect is eliminated by H_2O quenching from above 600°F, if the H content is less than 60 ppm. The H content may be lowered sufficiently by vacuum annealing to make Zr tough in the notched-bar impact test at temperatures as low as −80°C. (auth)

6051

Battelle Memorial Inst.

THERMAL CONDUCTIVITY AND ELECTRICAL RESISTIVITY OF HAFNIUM. H. W. Deem. July 14, 1953. 12p. (BMI-853)

Thermal-conductivity measurements by a steady-heat-flow method and electrical-resistivity measurements by a voltage-drop method were made on Hf containing about 2 wt. % Zr. The measured thermal conductivities, in watts/cm/°C, were 0.220 at 100°C, 0.210 at 300°C, and 0.205 at 500°C. The electrical resistivities, in μohm-cm, were 40.6 at 50°C and 60.1 at 200°C. Based on the resistivity at 0°C, the temperature coefficient of resistance is 0.00382/°C. (auth)

5052

California Research and Development Co., Livermore

MATERIALS HANDBOOK. PART 4. PROPERTIES OF TITANIUM. Harry Majors, Jr., R. T. Webster, R. H. Wallace, and G. E. Wendell. Apr. 1953. 60p. (CRD-A19-27(pt. 4))

The current knowledge concerning the physical and mechanical properties and the fabrication characteristics of Ti is summarized and tabulated. The composition and properties of some of its alloys are mentioned. (J.S.R.)

6053

California Research and Development Co., Livermore

MATERIALS HANDBOOK. PART 7. PROPERTIES OF TANTALUM. H. Majors, Jr., R. H. Wallace, R. T. Webster, and G. E. Wendell. Apr. 1953. 25p. (CRD-A19-27(pt. 7))

The present knowledge concerning the physical, mechanical, and chemical properties and fabrication characteristics of Ta is summarized. (J.S.R.)

6054

California Research and Development Co., Livermore

MATERIALS HANDBOOK. PART 8. PROPERTIES OF MOLYBDENUM. Harry Majors, Jr., R. H. Wallace, G. E. Wendell, and R. T. Webster. May 1953. 26p. (CRD-A19-27(pt. 8))

The current knowledge concerning the mechanical and physical properties and fabrication characteristics of Mo is summarized. (J.S.R.)

6055

Knolls Atomic Power Lab.

HEAT-TREATMENTS OF WELDED STRUCTURES FOR THE RELIEF OF RESIDUAL STRESSES WITH PARTICULAR REFERENCE TO TYPE 347 STAINLESS STEEL WELDMENTS. W. L. Fleischmann. Aug. 17, 1953. 30p. (KAPL-981)

Welded ring samples of type 347 stainless steel were given a number of different thermal treatments to study their effectiveness in relieving residual stresses. Treatment at temperatures of 1650°F and above caused complete relaxation. At lower temperatures the amount of relaxation obtainable in reasonable periods depended upon the magnitude of the residual stresses. Experiments conducted on twisted type 347 stainless steel wire showed that relaxation occurred at low temperatures. A treatment at 1100°F produced some untwisting and established a pattern of residual stresses that did not cause any further movement when the wire was cycled from room temperature at 850°F. High-temperature treatments produce metallurgical changes which may be of greater importance in conditioning the weld for the intended service than the fact that residual welding stresses were relieved. To emphasize the over-all effect of heat treatments of welded structures, the use of the term "thermal conditioning" is suggested in place of "stress relieving." (auth)

6056

North American Aviation, Inc.

THE INFLUENCE OF COLD WORK AND RADIATION DAMAGE ON THE DEBYE TEMPERATURE OF COPPER. D. B. Bowen and G. W. Rodeback. Issued Sept. 1, 1953. 17p. (NAA-SR-254)

Cu wires have been cold worked or subjected to radiation damage. Simultaneous measurements of resistance have been made on a damaged wire and a well annealed wire. The resistance measurements are made over the temperature range from 4.2 to 77°K. The differing behavior of the temperature dependent portions of the resistivities of the two wires has been interpreted as a decrease of Debye temperature in the damaged sample. The maximum change observed is 45°. The thermal annealing of this change has been followed. Some thermodynamic implications of these changes are suggested. (auth)

6057

Metals Research Lab., Carnegie Inst. of Tech.

THE FREE ENERGY CHANGE OF AUSTENITE-PEARLITE TRANSFORMATIONS; ANNUAL REPORT [FOR] JUNE 1, 1952 TO JUNE 1, 1953. Guy M. Pound and William C. Hagel. June 16, 1953. 20p. (NP-4719)

Current interest in the application of thermodynamics to problems of the pearlite transformation indicates a need for further experimental investigation of the effects of interlamellar spacing and alloy content upon free-energy change. Many measurements are available for specific heats and enthalpy changes for C eutectoid steel from which the free energy change may be calculated. The absence of truly reliable values indicates that either experimental technique needs to be improved or the variables of interlamellar

spacing and the associated interfacial free energy have an important effect upon the energetics of the system. By designing and operating a high-temperature, continuously measuring calorimeter in conjunction with very sensitive recording and control instruments, it was found possible to obtain reliable thermal measurements pertinent to the pearlite transformation. Several experiments have been conducted which show that the calorimeter constructed here can give results that are sufficiently accurate and reproducible to permit calculation of the pearlite free-energy change in C-alloy eutectoid steel and of the cementite-ferrite interfacial free energy. (auth)

6058

Massachusetts Inst. of Tech.

DIFFUSION PROCESSES ASSOCIATED WITH METALLURGICAL PHENOMENA; PROGRESS REPORT FOR THE PERIOD AUGUST 1952 TO NOVEMBER 1952. [nd] 9p. (NP-4732; Progress Report 5; AD-8263)

The relation between sub-grain boundaries and sharp bands in high purity Al as revealed by the etch pit technique and electrolytic etching was determined. The etch pit technique is the more sensitive method of revealing sub-grains, but electrolytic etching indicates regions with greater differences in angle between the sub-grains and does not obscure the background with excessive pitting. Two processes of sub-grain formation bending and polygonization, can be distinguished. Basal and pyramidal slip, grain boundary migration and fold formation, and the formation of sub-grains were the modes of deformation found during creep deformation of Mg at 700°F. No twinning took place. (J.S.R.)

6059

Horizons Inc.

RATE OF DIFFUSION OF CARBON IN ALPHA AND IN BETA TITANIUM AS A FUNCTION OF THE TEMPERATURE AND CONCENTRATION; INTERIM TECHNICAL REPORT [FOR] PERIOD MARCH 12 TO JUNE 11, 1953. Eugene Bucur and F. C. Wagner. July 14, 1953. 16p. (NP-4761; Interim Technical Report 2)

Diffusion couples were successfully made by butt welding Ti specimens together with no visible oxidation at the bond. Runs were conducted with the vacuum furnaces at maximum temperature to check the temperature control and ultimate vacuums obtainable. Further C analyses were made with Ti samples to test the accuracy of the analytical equipment. (auth)

6060

Notre Dame Univ.

ORDER-DISORDER TRANSFORMATIONS IN METALLIC ALLOYS; CONTRACTOR'S TECHNICAL REPORT FOR THE PERIOD JULY 17, 1953 TO AUGUST 17, 1953. Aug. 17, 1953. 3p. (NP-4763; Contractor's Technical Report 10)

A study of the "diffusionless" ordering in Au-Cu alloys discovered previously extending beyond the "linear" region was made. Rates of reaction and induction periods were determined. It was found metallographically that the diffusionless reaction, observed between 400 and 380°C, extends to lower temperatures with increasingly longer incubation periods. (J.E.D.)

6061

Battelle Memorial Inst.

HEAT TREATMENT, STRUCTURE, AND MECHANICAL PROPERTIES OF TITANIUM-MANGANESE ALLOYS; THE EFFECT OF MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF TITANIUM ALLOYS. F. C. Holden, H. R. Ogden, and R. I. Jaffee. May 11, 1953. 88p. (NP-4769; Interim Report 3)

The effects of solid solution, structure, and β-phase transformation on the mechanical properties of Mn-Ti alloys are shown, and the interrelations between the strengthening mechanisms are discussed. High-purity alloys containing 0.55 to 12.1% Mn were used in the work as representative of this type of alloy system. Methods of preparation are briefly outlined. (J.E.D.)

6062

Illinois Univ.

A TENTATIVE THEORY OF METALLIC WHISKER GROWTH. J. D. Eshelby. June 1953. 6p. (NP-4771; Technical Report 8)

The observation by Koonce and Arnold (J. Applied Phys. 24, 365(1953)) that metallic whiskers grow at the root seems to rule out the explanation by Peach (J. Applied Phys. 23, 1401(1952)) for their formation. It has also been observed that the growth seems to be influenced by the atmosphere over the surface. In view of these observations a model is presented from which additional theory is obtained regarding their formation and growth rate. (L.M.T.)

6063

Magnesium Labs., Dow Chemical Co.

FUNDAMENTALS OF HOW ALLOYING INGREDIENTS AFFECT PROPERTIES OF MAGNESIUM. QUARTERLY STATUS REPORT, DECEMBER 1, 1950 TO MARCH 1, 1951. 13p. (NP-4786; Quarterly Status Report 3)

A study is made of the effect of temperature on the unit cell size of Mg-Ag and Mg-Sn alloys, the behavior of single crystals when deformed in a polycrystalline aggregate, the effect of a critical electron concentration on energy absorption, and a correlation of solid solution hardness with alloy factors. (For preceding period see NP-4785.) (J.E.D.)

6064

Metallurgical Labs., Dow Chemical Co.

FUNDAMENTALS OF HOW ALLOYING INGREDIENTS AFFECT PROPERTIES OF MAGNESIUM. Aug. 23, 1951. 11p. (NP-4787; Quarterly Status Report 4)

Data are presented on the microhardness of several Mg binary alloys, the tensile properties of a series of Mg-Zr-Al alloys, and the effect of atomic and ionic radii on the hardness of solid-solution alloys. (L.M.T.)

6065

[Yale Univ.]

STUDY OF VARIOUS ASPECTS OF THE DIFFUSION PROCESS IN ALLOYS APPLYING THE RELAXATION METHOD. PROGRESS REPORT FOR THE PERIOD JULY 1–SEPTEMBER 30, 1952. Arthur S. Nowick. Oct. 7, 1952. 8p. (NP-4800; ATI-174950; Progress Report 2)

The rate of dissappearance of vacancies which have been frozen in during quenching was measured for a Ag-Zn alloy. Such measurements require a study of the variation of the rate of relaxation, τ, with time after quenching. This is determined from the relation $\tau(o)/\tau = c(t)/c(o)$, where $\tau(o)$ is the initial rate of relaxation, $c(o)$ is the concentration of vacancies frozen in during quenching, and $c(t)$ is the concentration of vacancies at any time, t. Curves are presented for $\tau(o)/\tau$ vs. time at four different temperatures and for $\tau(o)/\tau$ vs. time at 50°C for two runs to show the effect of handling the specimen over a period of time. In addition, preliminary results are presented for internal friction experiments made by running a specimen rapidly up to 280° and taking measurements rapidly as the specimen cooled. (L.M.T.)

6066

Research and Development Board

SYMPOSIUM ON VAPOR DEPOSITION OF METALS. May 8, 1950. 80p. (NP-4821; ATI-193932)

The techniques and applications of plating by vapor deposition are reviewed. There are six processes for deposition: evaporation, cathode sputtering, decomposition

of metal compounds, reduction of metal compounds, surface reaction with gas, and impregnation with Al, Cr, Si, or Zn. The decomposition of metal carbonyls and halides is discussed in some detail. (J.S.R.)

6067

Institute of Engineering Research, Univ. of Calif., Berkeley
EFFECT OF COLD WORK ON THE HIGH TEMPERATURE CREEP PROPERTIES OF DILUTE ALUMINUM ALLOYS. Robert E. Frenkel, Oleg D. Sherby, and John E. Dorn. Aug. 1, 1953. 26p. (NP-4829; Technical Report 29)

The creep rate of annealed and cold-worked Al alloys at elevated temperatures can be represented by the equation $\epsilon = Se^{-\Delta H_c/RT}e^{B\sigma}$, where ΔH_c = activation energy for creep, R = gas constant, T = absolute temperature, σ = applied stress, B = stress parameter, and S = structure parameter. The activation energy for creep is unaffected by cold work, and S is only slightly increased by the previous cold deformation. The principal effect of cold work on the creep resistance of Al appears to arise from a decrease in B by this factor. The results are discussed in terms of a new recovery model for creep. (auth)

6068

Institute of Engineering Research, Univ. of Calif., Berkeley
A RECOVERY MODEL FOR THE HIGH TEMPERATURE CREEP PROCESS. O. D. Sherby and J. E. Dorn. Aug. 15, 1953. 18p. (NP-4830; Technical Report 30)

A review is made of some of the current theories on creep, and these theories are rejected because they do not appear to agree with the experimental facts. A new model for creep is presented wherein the rate-controlling process at high temperatures is attributed to the recovery of barriers by a self-diffusion process. The creep rate is shown to be represented by $\dot{\epsilon} = ndk.B\lambda e^{-\Delta H/RT}e^{B\sigma}$, where n is the number of dislocations per square centimeter, d is the mean free path between barriers, k is related to the diffusion constant, λ is the atomic spacing in the slip direction, ΔH is the activation energy for self-diffusion, R is the gas constant, T is the absolute temperature, σ is the applied creep stress, and B is a constant. This formulation is shown to agree with experimental data for high temperature creep. (auth)

6069

New York Univ. Coll. of Engineering
AN ANALYSIS OF THE ORTHOGONAL BORING OPERATION. Bernard W. Shaffer. Aug. 1953. 38p. (NP-4831; Technical Report 1)

The shear line, during the orthogonal boring operation, was found to be a circular arc extending from the tip of the tool and separating the uncut workpiece from the newly formed chip. Its orientation with respect to the cutting tool was prescribed by the condition that the element within the chip, at the base of the tool, did not exceed the yield point of the material as the cutting force was transferred from the tool to the shear line. Under these conditions, a shear angle relationship, an expression for machining force, and an expression for the chip-thickness ratio were derived for orthogonal boring. It was found, by examining these equations, that as the internal radius of the workpiece increases the shear angle increases and the machining force decreases whenever a given depth of cut is taken under identical machining conditions. At the same time, the chip-thickness ratio increases for small friction angles, and decreases for large friction angles. As the internal radius of the workpiece increases, the analytical expressions approach the corresponding equations found for the orthogonal planing operation. (auth)

6070

North Carolina State Coll.
A METALLOGRAPHIC STUDY OF THE SOLIDIFICATION OF CASTINGS. FINAL REPORT [FOR] PERIOD JUNE 12, 1951 TO JUNE 12, 1952. B. F. Brown. July 12, 1952. 59p. (NP-4843; ATI-171745)

A new primary method has been developed to study the mechanism of the solidification of small metal castings, with a view toward improving the understanding of solidification and shrinkage phenomena. This method, essentially a metallographic study of castings quenched when partially solidified, was successfully tried on a number of nonferrous metals and alloys under different conditions, and the results of these studies are described. (auth)

6071

Battelle Memorial Inst.
THE EFFECT OF HYDROGEN ON THE MECHANICAL PROPERTIES OF TITANIUM ALLOYS. SUMMARY REPORT. G. A. Lenning, C. M. Craighead, and R. I. Jaffee. July 31, 1953. 84p. (NP-4855)

Results are given on the effects of H on the structure and mechanical properties of high-purity and commercial-purity Ti, α Ti alloys of the Ti-N and Ti-Al types, two commercial α-β alloys (RC-130A and RC-130B), and high-purity Ti-Mn alloys. This work indicates that H does not have any beneficial effects and is an impurity that must be kept under close control in order to obtain the maximum advantage from Ti alloys. The mechanism of H embrittlement of Ti and α alloys is shown to be different from that of the α-β alloys. (auth)

6072

[Special Library Association]
BIBLIOGRAPHY OF RECENT LITERATURE ON METALS AT ELEVATED TEMPERATURES. G. Meixell Snyder and F. Edith Manley. [Oct. 15, 1951] 26p. (NP-4890)

The five publications of the Joint Research Committee on effect of temperature on the properties of metals, of the American Society for Testing Materials, and the American Society of Mechanical Engineers, 1924 to 1938, and H. S. Tapsell's classic on the creep of metals, 1931, have been included for their basic bibliographies; otherwise, only recent books have been listed. Since most of these books are well documented through 1948, the list of periodical material includes only a few late 1948 references and material for 1949 to 1951. Neither list is exhaustive, but rather gives a general over-all picture of the literature on metals at elevated temperatures. (auth)

6073

General Electric Research Lab.
SURFACE AND INTERFACIAL TENSIONS OF SINGLE-PHASE SOLIDS. J. C. Fisher and C. G. Dunn. Nov. 1950. 39p. (RL-463)

The published values of surface and interfacial tensions of single-phase solids are collected, evaluated, and tabulated. Several errors in the literature are corrected. Reasonably good values are obtained for the surface tensions of solid Cu, Ag, and Au, for the grain- and twin-boundary tensions in Cu and for the variation in grain-boundary tension with orientation of the adjacent grains in silicon Fe, Sn, and Pb. (auth)

6074

Battelle Memorial Inst.
CHEMICAL SURFACE TREATMENT OF TITANIUM; INTERIM TECHNICAL REPORT. H. A. Pray, P. D. Miller, and Richard A. Jefferys. May 30, 1953. 48p. (WAL-401/45-26; Interim Technical Report 3)

An extensive survey of chemical treatments of Ti and its alloys has produced two immersion treatments that offer useful and practical coatings on Ti alloys. These coatings, when subjected to a low-temperature thermal treatment, possess additional properties of wear resistance, which reduce the galling tendency of Ti. The most notable aspect of this treatment is the production of a wear-resistant

surface without change in the core properties of the Ti metal produced in treatments such as carburizing or nitriding. (auth)

6075

Carnegie Inst. of Tech.

THE EFFECT OF INTERNAL HEATING ON THE FATIGUE PROPERTIES OF TITANIUM, INTERIM REPORT. J. P. Romualdi and E. D'Appolonia. July 1953. 51p. (WAL-401/68-28)

A continuous time record of temperature and deflection was obtained during fatigue tests of Ti specimens under isothermal and nonisothermal conditions. The tests were conducted at different stress levels and at speeds ranging from 1,000 to 10,000 rpm. (J.E.D.)

6076

Wright Air Development Center

AN INVESTIGATION OF VARIOUS PROPERTIES OF NiAl. Richard L. Wachtell, American Electro Metal Corp. Sept. 1952. 44p. (WADC-TR-52-291; AD-12965)

Production of the alloy NiAl and a modified composition NiAl + 5% Ni has proved feasible, as well as its subsequent fabrication by powder metallurgical technique. Properly hot-pressed bars of the NiAl + 5% Ni composition show strengths in modulus of rupture as high as 144,000 psi at room temperature and 68,000 at 980°C. The air oxidation resistance of the modified NiAl + 5% Ni composition is excellent up to 1095°C, with weight gains of the order of 1.25 mg/cm^2 being exhibited after 300 hr of exposure. Heat shock properties are likewise excellent, as judged by NACA tests, and by performance in the Air Force heat shock apparatus. (auth)

6077

X-RAY ANALYSIS OF THE INITIAL STAGES OF AGING OF BERYLLIUM BRONZE. A. M. Elistratov [Yelistratov], S. D. Finkelshtein, and T. Yu. Goldshtein. Translated from Doklady Akad. Nauk S.S.S.R. 88, 669-72(1953). 5p. (NSF-tr-63; D-88-669)

Pure Be bronze samples (2.02% Be) in the form of wires 0.3 to 1 mm in diameter were heated at 880° for 1 to 2 hr and quenched in water. The samples were then tempered at temperatures up to 220°. Small γ-structure regions in the form of platelets formed in the crystal of the solid solutions. These platelets caused local distortions in the thick layer of solid solution adjacent to them. The γ-structure regions dissolve and reappear until they agglomerate in platelet regions. The platelet regions consist of individual anti-phase blocks of γ structure. (J.S.R.)

6078

MAGNETIC MOMENTS AND THE CRYSTAL STRUCTURE OF FERROMAGNETIC METALS AND ALLOYS. F. Galperin. Translated from Doklady Akad. Nauk S.S.S.R. 88, 643-6(1953). 5p. (NSF-tr-68; D-88-643)

An attempt is made to show that the previously reported radical difference between the "ferrimagnetism" of ferrites having the general chemical formula $M^{2+}_{1-b}Fe^{3+}_{b}(Fe^{3+}_{2-b}M^{2+}_{b})O_4$, and ferromagnetism does not actually exist. A formula for the magnetic moment of a positive ion of a pure ferromagnetic metal is given. Examples of the applications of this equation to pure metals, pure ferrites, and the high coercive-force chemical compounds of Ba oxides and Fe oxides are tabulated. Additional information showed the dependence of the molecular magnetic moments of mixed ferrites on the concentration of the components. (J.A.G.)

6079

DISPLACEMENT OF GRAIN BOUNDARIES IN ANNEALED METAL. I. A. Oding, M. G. Lozinskii [Lozinsky], and S. G. Fedotov. Translated from Doklady Akad. Nauk S.S.S.R. 91, 75-7(1953). 4p. (NSF-tr-73; D-91-75)

Samples of U-12 steel and Sn bronze were annealed in vacuo by serving as conductors of an a-c current of industrial frequency. The following conclusions were drawn from a photographic examination of the samples. When the grain boundaries are displaced, they preserve their curvilinear shape. The inequality of the contact angles of three adjoining grains also causes displacement. The displacement of the grain boundaries is not continuous but discrete. In U-12 steel the grain boundary "jumps" about 5 to 6 μ; in Sn bronze, about 3.0 to 4.5 μ. (J.S.R.)

6080

JUMPLIKE DEFORMATION IN THE LINEAR "ELASTIC" RANGE OF THE STRAIN DIAGRAM. N. F. Syutkin. Translated from Doklady Akad. Nauk S.S.S.R. 91, 83-5 (1953). 3p. (NSF-tr-74; D-91-83)

The stress-strain diagrams of samples of Al-Zn alloy (20% Al) in the form of wires 2 and 2.3 mm in diameter and 30 and 35 mm in length were examined. If the intensity of the light source is quite weak, the main curve disappears and the diagram consists of separate points. A microscopic examination of the points reveals an irregularity typical of jumplike deformations. The first "jump" occurs well below the elastic limit. As the temperature rises the stress necessary for the first jump is quite low and almost independent of the rate of deformation. (J.S.R.)

6081

ON THE THERMODYNAMICS OF SIMPLE CARBIDES IN STEEL. N. S. Fastov and B. N. Finkelstein. Translated from Doklady Akad. Nauk S.S.S.R. 89, 677-9(1953). 3p. (NSF-tr-77; D-89-677)

The effect of any alloying element on the properties of a steel depends on whether the element is contained in the basic solid solution or in the insoluble carbide. A steel heated to a state of thermodynamic equilibrium would have two phases – austenite alloyed by some element and a carbide of the element. The thermodynamics of such a system are considered for the case of an Fe-C-V system in the temperature range of γ Fe. Expressions for the composition of the two phases are derived. Although, in this case, V is the alloying element, the same solution would be true for other carbides of the same type. (J.S.R.)

6082

FERROELECTRIC PROPERTIES OF $BaTiO_3$-$PbZrO_3$ SOLID SOLUTIONS. G. A. Smolenskii [Smolensky], A. I. Agranovskaya, and N. N. Krainik. Translated from Doklady Akad. Nauk S.S.S.R. 91, 55-8(1953). 5p. (NSF-tr-81; D-91-55)

$BaTiO_3$-$PbZrO_3$ solid solutions were prepared by pressing finely powdered $BaTiO_3$ and $PbZrO_3$ and baking at 1150 to 1450° for one hr in an atmosphere of PbO. The variation of the dielectric constant in weak fields and the relative change in length with temperature were graphed. The dependence of the Curie temperature of solid solutions of $BaTiO_3$-$PbZrO_3$ on the concentration of $PbZrO_3$ in the solution was determined and graphed. (J.S.R.)

6083

INTERNAL FRICTION AND SHEAR MODULUS OF PURE COPPER AND BERYLLIUM BRONZE. V. S. Postnikov. Translated from Doklady Akad. Nauk S.S.S.R. 91, 79-82 (1953). 4p. (NSF-tr-86; D-91-79)

Changes in the internal friction and shear modulus of pure Cu and Be bronze as a function of temperature and heating time have been studied. The internal friction increases and the shear modulus decreases with rise of temperature. The dependence of internal friction and shear modulus on temperature is quite different for Cu and Be bronze. (J.S.R.)

6084

PRINCIPAL TYPES OF PHASE DIAGRAMS IN A BINARY

SYSTEM WITH A TITANIUM BASE. I. I. Kornilov. Doklady Akad. Nauk S.S.S.R. 91, 549-52(1953) July 21. (In Russian)

An examination of the allotropic modifications of Ti, the α with a hexagonal and the β with a face-centered crystal lattice, reveals four types of phase diagrams of its alloys—a system with an uninterrupted solid solution of α and β Ti, a system with an uninterrupted solid solution of β Ti and a limited solid solution of α Ti, a system with a limited solid solution of α and β Ti and with an eutectic component, a system with limited solid solution of α and β Ti and with a peritectic component. The phase diagram of each system is given, and some alloys are briefly discussed. (J.S.R.)

6085

IRREVERSIBLE POTENTIALS AND CORROSION BEHAVIOR OF ALUMINUM IN BUFFERED SOLUTIONS. A. Ya. Shatalov and Yu. A. Mikhaĭlovskiĭ. Zhur. Fiz. Khim. 27, 1025-31(1953) July. (In Russian)

The electrode potential of Al in buffered solutions of chloride ions with a pH range from 2 to 12 was investigated. The irreversible potential of Al is changed by the pH, with the curve first falling with rise in pH and then rising sharply at pH 8. The potential is graphed against the current density for a constant pH and constant Cl^- concentration. Corrosion curves are given. (J.S.R.)

PHYSICS

6086

Nuclear Physics Labs., Columbia Univ.

PROGRESS REPORT FOR JULY, AUGUST, SEPTEMBER 1952 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Jan. 21, 1953. 38p. (CU-117)

The general relationship between σ_0 and Γ in resonance area measurements for a single sample thickness has been evaluated and can be expressed in the form $\Gamma = f(\sigma_0)$. Investigation of transmissions on Ag revealed evidence of neutron production for a period longer than the arc-on time. This gave values of $\sigma_0\Gamma^2$ that were markedly at variance with those previously given. A new determination of the grating space of Be leads to a correction of the 2.23-ev resonance in Te^{123}. Analysis of the 16.6-ev resonance level in Ag showed that the value of $\sigma_0\Gamma^2$ of 23 barns $(ev)^2$ obtained from transmission measurements at Harwell and Columbia was completely incompatible with the scattering data. A value of $\sigma_0\Gamma^2$ of 100 barn $(ev)^2$ is necessary to obtain agreement. The results of scattering measurements on the 2.3-ev level of Te, the 126-ev level of Co, and the 345-ev level of Mn are presented. The redetermination of the ft value for He^6 gives a maximum value for the matrix element σ^2 of 5.4 instead of 6.0. A preliminary investigation has been made of the β-ν recoil experiment in O^{14}. The shapes of $\Delta 1 = 2$, no forbidden spectra, are being analyzed to obtain ratios consistent in the mixture of Fermi and Teller-Gamow parts. Paramagnetic scattering measurements have been completed with the Brookhaven slow chopper. The compounds measured contained either Mn^{+2} or Fe^{+3}, both of which are in S states. These ions can represent three degrees of electron-spin interaction. The paramagnetic cross section for Mn^{+2} in MnF_2 behaved in accordance with the Halpern and Johnson elastic form factor. The paramagnetic cross sections for Fe^{+3} in FeF_3 and $ZnFe_2O_4$ varied in a form factor dependent manner. Results in MnO at room temperature show a slight form factor dependence for $\lambda < 8A$. The magnetic cross section becomes increasingly larger, suggesting that the inelastic effect is very important for lower neutron energies. At 80°K, a sharp break was observed which is attributed to the loss of incoherent magnetic scattering. Magnetic scattering in the ferromagnetic ferrites showed a considerable cross section which varied as 1/v. The theory of the effect is being worked out. (auth)

6087

General Engineering and Consulting Lab.

TESTS OF TEMPERATURE-RESISTANCE RELATIONS FOR INSULATING MATERIALS. J. E. Bigelow. Sept. 16, 1949. 7p. (DF-49GL151)

Tests made to display the response of an unsealed ionization chamber vs. temperature showed that the chamber current decreased with temperature. The desirability of a sealed chamber was thus established. The temperature-resistance curve of a number of insulating materials is given. (J.S.R.)

6088

Institute for Atomic Research, Iowa State Coll.

VARIATIONS IN THE DECAY OF PHOSPHORESCENCE WITH FREQUENCY OF APPLIED ELECTRIC FIELD. Keith W. Olson. Sept. 30, 1953. 4p. (ISC-406)

Destriau (Phil. Mag. 38, 700, 784, 880 (1947)) has reported on the momentary illumination and extinguishing effects of an electric field applied to a phosphor which has a long phosphorescence decay time. The effects of varying the frequency of the applied field on the wavelength of maximum phosphorescence intensity from an ultraviolet excited ZnS/CdS:Cu phosphor have been examined. The qualitative features of three variations are discussed. (auth)

6089

National Bureau of Standards

OSCILLATOR STRENGTH OF IONIZING TRANSITIONS. DATA CALCULATED IN THE HYDROGENLIKE APPROXIMATION. Margaret N. Lewis. Apr. 21, 1953. 123p. (NBS-2457)

A graphical presentation of oscillator-strength data derived from the H-like approximation and a general survey of the oscillator-strength problem are given. Oscillator strength and its applications are discussed, including the concept of oscillator strength, polarizability of atomic changes, dielectric constant and index of refraction, absorption of radiation, emission of radiation, cross section for coherent scattering, inelastic collisions of fast particles, independent electron approximation, distribution of oscillator strengths, experimental determination of oscillator strength, and theoretical calculation of oscillator strength. Additional discussions on the H-like approximation, oscillator strength for the H atom, and the adaptation of hydrogenic oscillator strengths to other substances are included. (J.A.G.)

6090

National Bureau of Standards

AN ACOUSTIC VISCOMETER FOR GASES. [PART] 1. Martin Greenspan and Francis N. Wimenitz. Jan. 2, 1953. 25p. (NBS-2658)

Frequency-response measurements were made on several double Helmholtz resonators containing air. From the data so obtained, the viscosity of air was computed on the basis of the classical theory of Kirchhoff. The results are not in agreement with the known viscosity of air, and it is concluded that this method does not at present furnish a satisfactory basis for the construction of an acoustic viscometer. However, the material of this report would be of value for this purpose if the discrepancies should in the future be explained in terms of a revision of theory or of systematic error in technique. (auth)

6091

Upper Atmosphere Research Lab., Boston Univ.
TECHNICAL PUBLICATION ABSTRACTS ON IBM PUNCHED CARDS. [PART] 1. Ward C. Low. July 14, 1952. 28p. (NP-4740; Technical Note 15; ATI-166645)

Characteristics of IBM punched cards are briefly described, with particular application to their use as index and abstract bibliographic reference cards. Illustrations are included to show how such a system might actually be utilized in searching card files for references on particular subjects. In principle, an unlimited number of cards can be sorted with high efficiency by machine methods to select those cards which identify publications treating selected subjects, employing certain types of equipment, etc. The suggestion is made that a suitable code system be developed and a "central agency" be set up to accomplish the abstracting, card indexing, and card dissemination functions for the benefit of other interested agencies. (auth)

6092

Utah Univ.
THE DETERMINATION OF THE NATURAL FREQUENCIES OF SPECIAL BEAM CONFIGURATIONS. STUDIES IN APPLIED MATHEMATICS NO. 5. L. C. Barrett and C. R. Wylie, Jr. Apr. 1, 1952. 82p. (NP-4819; Technical Report 3)

By the classical method of separating variables in the partial differential equation of beam vibration and imposing the appropriate boundary conditions on the resulting product solutions, the frequency equations for several important beam configurations are derived. (auth)

6093

Research Lab. of Electronics, Mass. Inst. of Tech.
PROPAGATION OF AN ELECTROMAGNETIC WAVE ALONG A HELIX SURROUNDED BY A RESISTANCE SHEATH. Andreas Tonning. May 13, 1952. 13p. (NP-4851; Technical Report 232)

The problem of wave propagation along a helix when losses are present arises in connection with the design of broadband traveling-wave tubes. Imperfect matching causes a part of the wave to be reflected at the output end of the tube. To reduce the amplitude of the reflected wave and thus avoid oscillations, it is convenient to surround the helix by a sheath of lossy material. In this report the effect of this resistance sheath on the phase velocity of the wave and the resulting attenuation is calculated. Only the case when no electron beam is present has been treated. It is shown that the introduction of losses in this way reduces the phase velocity and that the amount of this reduction approaches zero for very high and very low frequencies. (auth)

6094

Naval Research Lab.
DAMAGES RESULTING FROM LABORATORY VIBRATION AND HIGH-IMPACT SHOCK TESTS. Kenneth E. Woodward. Sept. 11, 1953. 36p. (NRL-4179)

The increasing complexity of equipment required on naval vessels and the extremely severe operating conditions encountered in their life has made it necessary that tests be devised which duplicate to a degree the maximum shock and vibration forces expected on shipboard for which protection is required. Higher degrees of equipment reliability and ruggedness are therefore needed than would otherwise be necessary for static loadings. An attempt is made in this report to show what is actually happening to the equipment with emphasis placed on those areas most susceptible to damage. Solutions to some of the problems are presented that have proven to be satisfactory in reducing or eliminating many of the damages in previously tested units. The nature of the subject and the available data leads to a discussion of the relative merit of shock isolators vs. no isolators in the over-all mounting and protection picture. The material is based on a study of 270 individual equipments which were subjected to Navy vibration and high-impact shock tests by the Shock and Vibration Branch, Test and Evaluation Section, of the Naval Research Lab. between November 1944 and August 1952. (auth)

6095

INTERACTION OF ULTRASONIC WAVES IN LIQUIDS. C. D. Mikhailov. Translated from Doklady Akad. Nauk 89, 663-4(1953). 3p. (NSF-tr-70; D-89-663)

Two ultrasonic waves of frequency 1 and 4 Mc are superimposed upon one another in solutions of turpentine and turpentine-vaseline. The sum and difference frequencies, picked up by a quartz detector, are found to be a function of the absorptive properties of the medium for ultrasonic waves. (K.S.)

6096

THE THEORY OF THE VISCOSITY OF HELIUM II. 2. CALCULATION OF THE VISCOSITY COEFFICIENT. L. D. Landau and I. M. Khalatnikov. Translated from Zhur. Eksptl' i Teoret. Fiz. 19, 709-26(1949). 33p. (AEC-tr-1255)

The kinetic equations for rotons and phonons are solved by using effective differential cross sections for the scattering of elementary excitations (phonons and rotons) by each other, as obtained in the first part of this work. It is shown that the viscosity coefficient of He II is composed of two parts: one caused by scattering of rotons ("roton viscosity") and not dependent on temperature; the other caused by scattering of phonons ("phonon viscosity") and sharply increasing with fall in temperature. The experimental values for the viscosity coefficient in He II appear to be in good agreement with theory. (auth)

6097

THE THEORY OF THE VISCOSITY OF HELIUM II. I. COLLISIONS OF ELEMENTARY EXCITATIONS IN HELIUM II. L. D. Landau and I. M. Khalatnikov. Translated from Zhur. Eksptl' i Teoret. Fiz. 19, 637-50(1949). 23p. (AEC-tr-1256)

A theory describing the viscosity characteristics of He II is presented. This section deals principally with interaction and excitation considerations based on phonon and roton theory. (K.S.)

6098

RESULTS OF LOW TEMPERATURE RESEARCH. XI. A PLANT FOR LIQUEFACTION OF HYDROGEN OF TECHNICAL PURITY. Klaus Clusius. Z. Naturforsch. a8, 479-93(1953) Aug. (In German)

A H-liquefaction plant of 7-l/hr capacity is described. The liquefier is distinguished by a built-in purifier with which the H can be freed of all condensable impurities in the low-pressure stage, thus making the trouble-free liquefaction of commercial H possible. The plant reaches the temperature of liquid H in 12 min with the expenditure of 3.5 kg of liquid N. Some suggestions and precautions for work with liquid H are suggested. (G.Y.)

6099

ELECTRON MULTIPLICATION IN SILICON AND GERMANIUM. K. G. McKay and K. B. McAfee. Phys. Rev. 91, 1079-84(1953) Sept. 1.

Electron multiplication in Si and Ge has been studied in the high fields of wide p-n junctions for voltages in the prebreakdown region. Multiplication factors as high as 18 have been observed at room temperature. Carriers injected by light, α particles, or thermal generation are multiplied in the same manner, The time required for the multiplication process is less than 2×10^{-9} sec. Approximately equal multiplication factors are obtained for injected electrons and injected holes. The multiplication increases rapidly as

"breakdown voltage" is approached. The data are well represented by ionization rates computed by conventional avalanche theory. In very narrow junctions, no observable multiplication occurs before Zener emission sets in, as previously reported. It is incidentally determined that the efficiency of ionization by α particles bombarding Si is 3.6 ± 0.3 ev per electron-hole pair produced. (auth)

6100

LORENTZ–KAMERLINGH ONNES CENTENARY CONFERENCE ON ELECTRON PHYSICS IN LEIDEN. F. J. Belinfante. Science 118, 393-9(1953) Oct. 9.

At this conference, held June 22 to 27, 1953, distinguished scientists from 13 countries presented papers on the properties of conductors at low temperatures, quantum electrodynamics, and field theory. The information presented is summarized in some detail. In particular, an extensive report of Pais' new theory of heavy particles in interaction with mesons is presented. (G.Y.)

AEROSOLS

6101

Chemical and Radiological Labs., Army Chemical Center A NEW SAMPLING TECHNIQUE FOR SMALL AIRBORNE PARTICULATES. PARTICLE SIZE DISTRIBUTION BY COMBINED USE OF LIGHT AND ELECTRON MICROSCOPE; INTERIM REPORT. James D. Wilcox and W. R. Van Antwerp. Feb. 18, 1952. 11p. (CRLIR-70)

The sampling technique described permits a particle size analysis of very heterogeneous samples with particles ranging from 0.1 to 100 μ. The particulate matter is removed from the air and deposited directly onto an electron microscope specimen film. A five-stage cascade impactor is used to obtain a partially size-graded sample. The analysis is first made with the light microscope and then with the electron microscope. The number of particles in the complete sample is found by addition of the data from both microscopes. (J.S.R.)

COSMIC RADIATION

6102

RECOIL TRACKS OF NUCLEAR DISINTEGRATION STARS PRODUCED IN COSMIC RADIATION. M. Grilli and B. Vitale. Nuovo cimento (9) 10, 1047-78(1953) Aug. 1. (In Italian)

The characteristics of recoil tracks of stars associated with nuclear disintegrations produced by cosmic radiation have been experimentally studied and statistically analyzed using the Monte Carlo method. The range and angular distributions with respect to the vertical for recoil tracks for three types of stars (energy of the primary between 0 and 300, 300 and 500, and 500 and 1000 Mev) are given. The recoils are directed preferably in the forward direction with respect to the vertical; the values assumed by the ratio R = forward recoils/backward recoils for those categories are: R = 1.6, 1.7, 1.3. The distributions of angles $(\theta - \theta_r)$ formed by the tracks and the recoil for black and "fast" $(I/I_0 < 6.5)$ tracks show a marked anisotropy with a preference for angles near 180°. The mechanism for the formation of the recoil is the following: during the interaction of the primary with the nucleus and the consequent process of the nuclear cascade, a momentum is transferred to the nucleus by the following mechanisms: acceleration of the primary when it enters the nucleus; emission from the nucleus of nucleons that, in the cold nucleus, had a finite momentum; deceleration of the knock-on nucleons as they leave the nucleus; reflection of part of the nucleons of the cascade on the inside surface of the nucleus. To this momentum is added that required by the nucleus during the subsequent evaporation. The total momentum transferred to the nucleus at the end of the disintegration has been determined graphically utilizing 150 examples of nuclear disintegrations constructed statistically by the Monte Carlo method, based on the angular and energy distribution of the tracks given by Bernardini et al. for disintegrations produced by 400-Mev protons. The greater number of recoils obtained by the Monte Carlo method have ranges less than 1 μ, and therefore are not visible in photographic emulsions. Therefore, the characteristics presented by the star have been analyzed separately according to whether the recoil was visible. The mean velocity assumed by the nucleus is $V_r = 1.6 \times 10^8$ cm/sec. The angular distribution of the recoil shows a net anisotropy in the forward direction with respect to the primary (R = 3.6 for all recoils, R = 9.5 for the visible recoils only). The frequency distributions of $(\theta - \theta_r)$ show a marked anisotropy near 180°, for black as well as fast tracks. The experimental data for the second category of stars (primary of energy 300 to 500 Mev) is in good agreement with the results of the Monte Carlo method; except that the anisotropy in the distribution of $(\theta - \theta_r)$ for black tracks is more marked than that predicted. This greater anisotropy renders plausible the existence of phenomena of local evaporation, barely present at this energy, and that becomes gradually more important resulting in the apparent effect of correlation found by other authors for α particles associated with very large stars. The agreement found allows us to consider as valid the proposed model: the formation of a visible recoil is associated with the coexistence of particular fluctuations in the behavior of both the cascade and the evaporation. When these fluctuations are present, the formation of the recoil is accompanied by several other features of the star. (auth)

6103

ELECTRONS AND PHOTONS IN EXTENSIVE COSMIC RAY SHOWERS. C. Milone. Nuovo cimento (9) 10, 1126-41 (1953) Aug. 1. (In Italian)

The ratio f/e = density of the photons/density of the electrons in the extensive cosmic-ray showers has been studied at Catania, 40 m above sea level. The selected showers have the highest frequency per density $\Delta \cong 2$ particles/m^2. The photons are detected by means of the method of anticoincidences by detecting the electrons produced in a Pb absorber of thickness h variable from 0 to 30 mm. In order to have some information on the ratio f/e either near or far from the cores of the selected showers, two arrangements E, designed for detecting the photons and the electrons, were placed, one in the proximity of the counters that selected the showers (d = 0) and the other 50 m away (d = 50 m). The surface of the counters in the arrangement E was much smaller than the surface of the counters selecting the showers, so that the probability that an electron and a photon of a shower strike at the same time the counters in arrangement E is very little. Avoiding in this way that the photons be disguised by the coherent electrons, information is deduced on the ratio f/e directly from the experimental results. It is found that $f/e \cong 1$ either for d = 0 or for d = 50 m (first approximation). The same result is reached including the cases in which an electron and a photon of a shower strike at the same time the detector E (second approximation). The behavior of the probability P_1 of finding below a thickness h of Pb at least an electron produced by a photon of a shower also is determined. The behavior of the function P_f, either for d = 0 or for d = 50 m, is not very different from the behavior of the function $\overline{P}_{ph}$ calculated by Arley assuming a given energy spectrum of the incoming photons. The coefficient of absorption of the photons in the showers also is determined, and it is found that $\mu = 0.53 \pm 0.06$ cm^{-1} Pb for

d = 0 and that $\mu = 0.50 \pm 0.06$ cm^{-1} Pb for d = 50 m. From these values of μ it is deduced that a high percentage of the photons in the selected showers have an energy lower than 10 Mev both for d = 0 or for d = 50 m. (auth)

6104

ALTITUDE AND GEOMAGNETIC EFFECTS OF POSITIVE AND NEGATIVE PENETRATING PARTICLES OF COSMIC RADIATION. I. F. Quercia and B. Rispoli. Nuovo cimento (9) 10, 1142-71(1953) Aug. 1. (In English)

Experiments performed on positive and negative penetrating particles of cosmic radiation at various altitudes and at different zenithal and azimuthal angles are described. The aim of these experiments was to get information on meson production processes. Positive excess, EW asymmetry, NS asymmetry, and zenital distributions for different energies and at different altitudes have been measured. All data collected have been compared with theoretical results of a plural production of mesons. Experimental results cannot be considered in disagreement with the theory. (auth)

6105

PRODUCTION OF LOW-ENERGY NEUTRONS IN COSMIC RADIATION. M. Galli. Nuovo cimento (9) 10, 1187-95 (1953) Aug. 1. (In Italian)

The theory of scattering of neutrons in the atmosphere is given an elementary treatment. In order to account for the 3.5 captures in air sec^{-1} cm^{-2} at energies less than 0.4 ev calculated by Yuan on the basis of his experimental results, and supposing that neutrons are all generated at 4 Mev, the total number of neutrons generated must be 22 ± 4 cm^{-2} sec^{-1}. The number of neutrons generated at height p (g cm^{-2}) must be 0.218 (exp [$-$p/157] $-$ 0.8 exp [$-$p/70]) sec^{-1} g^{-1} and the number of neutrons which escape the atmosphere does not reach 10% of the total number of generated neutrons. (auth)

6106

AN ANALYSIS OF "JETS" INITIATED BY HIGH ENERGY COSMIC RAYS. C. C. Dilworth, S. J. Goldsack, T. F. Hoang, and L. Scarsi. Nuovo cimento (9) 10, 1261-74(1953). Sept. 1. (In English)

A study has been made of the variation of the multiplicity of "jets" with the energy of the primary, deduced from the angular distribution of the secondaries. The analysis has been made both on the hypothesis of pure multiple production and following the model of Roesler and McCusker of production in a "tunnel" through the nucleus. (auth)

6107

APPLICABILITY OF THE CONCEPT OF RANGE TO THE ABSORPTION OF MUONS UNDERGROUND. M. Mandò and P. G. Sona. Nuovo cimento (9) 10, 1275-87(1953) Sept. 1. (In Italian)

The method of the range is not a priori justified to convert the intensity-depth relation of cosmic rays underground into the sea-level spectrum of high-energy muons and vice versa, when radiation losses are to be taken into account. The pertinent diffusion equation is therefore solved in a first approximation, by assuming that radiation losses are a small part of the collision losses, which are assumed energy-independent. It is concluded that, for a general initial energy spectrum, the range method is not correct even to first-order terms only; nevertheless, in the practical case, the method comes out to be sufficiently accurate down to great depths, owing to the peculiar form of the spectrum, which happens to approach a power spectrum with the (right) exponent -3. It is believed, however, that at greater depths tabulated first-order corrections should be applied for more accurate results, but final conclusions on this point could only be reached by solving the diffusion equation exactly or at least up to second-order terms. (auth)

6108

FURTHER RESULTS ON THE INTERACTION OF COSMIC RAYS UNDERGROUND. A. Lovati, A. Mura, C. Succi, and G. Tagliaferri. Nuovo cimento (9) 10, 1201-4(1953) Aug. 1. (In English)

Further cloud-chamber observations under 55 m w.e. of granite, taken to clarify conflicting statements in the literature concerning the production of penetrating secondaries by μ mesons with a cross section of 5×10^{-29} cm^2/nucleon in Pb, have led to the following conclusions: It seems quite unlikely that the cross section for production of penetrating secondaries by μ mesons should be appreciably higher than that for nuclear-disintegration production. Changing the producing layer from Pb to Al does not affect appreciably the observed frequency of pairs of associated penetrating particles. No example of pair production by ionionizing agents has been observed. In agreement with photographic-emulsion work, the presence of an energetic N component secondary to μ mesons is demonstrated by the cloud-chamber method. Evidence for the emission of π^0 mesons by cosmic-ray-induced underground disintegrations is presented. 6 figures. (G.Y.)

6109

NUMERICAL WORK ON THE FLUCTUATION PROBLEM OF ELECTRON CASCADES. Alladi Ramakrishnan and P. M. Mathews. Progr. Theoret. Phys. (Japan) 9, 679-81 (1953) June.

Reliable numerical work has been done in relation to the first moments of the distribution function for the number of electrons or photons above a certain energy in a cosmic shower initiated by a primary electron or photon passing through a given thickness of matter. Numerical results relating to the second moments were obtained by Scott and Uhlenbeck (Phys. Rev. 62, 497(1942)) and by Janossy and Messel (Proc. Phys. Soc. (London) 63, 1101(1950)). Results of calculations on the second moments by the authors are presented here and are found to be at variance with the earlier numerical work. (L.M.T.)

6110

TIME VARIATIONS OF COSMIC RAY INTENSITY ASSOCIATED WITH GEOMAGNETIC AND SOLAR ACTIVITY. B. Trumpy. Physica 19, 645-67(1953) July.

On the basis of continuous registrations of cosmic rays in the years 1949 to 1951, the changes of the cosmic-ray intensity connected with world-wide magnetic disturbances were studied. The variations of the intensity of three different components of cosmic rays were investigated in 42 cases of world-wide magnetic storms. The variations are invariably decreases, with a distinct diurnal variation. The magnetic disturbances were studied on the basis of the registrations from the magnetic observatories Dombås, Rude Skov, and Cheltenham. No simple connection exists between the changes in the earth's magnetic field during a storm and the corresponding changes in the cosmic-ray intensity. Possible theories for the decreases of the cosmic-ray intensity during magnetic storms are discussed. (auth)

6111

ON THE CORRELATION BETWEEN THE COSMIC RAY INTENSITY AND THE METEOROLOGICAL CONDITIONS. B. Trumpy and H. Trefall. Physica 19, 636-44(1953) July.

The results of continuous registrations of different components of cosmic rays in the years 1950 to 1952 are reported. The cosmic-ray intensity at sea level is correlated with the air pressure, the height of the 100-mb level, and the temperature just below this level. The barometric coefficient, the height coefficient, and the temperature coefficient are calculated for the total radiation and two different hard components. They were proved to be statistically significant. The coefficients for the soft component

alone were calculated from the corresponding coefficients for the hard component and the total radiation. On the basis of these values it may be concluded that a part of the soft component at sea level is not produced by the meson component. (auth)

6112
INVESTIGATION OF THE NON-IONIZING COMPONENT OF COSMIC RADIATION IN THE STRATOSPHERE. V. S. Zarya, Yu A. Smorodin and Z. I. Tulinovia. Doklady Akad. Nauk S.S.S.R. 91, 495-8(1953) July 21. (In Russian)

The number of nonionizing particles in cosmic radiation was determined by the difference in measurements made with and without Pb. Different configurations of Pb were used. A sheet of Pb 1 mm thick was surrounded by counters; a circle of Pb and a semicircle were also used. The number of particles/min was graphed against the energy for each of the experimental arrangements. (J.S.R.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

6113
Ames Lab.
THE CRYSTAL STRUCTURE OF SAMARIUM. A. H. Daane, R. E. Rundle, H. G. Smith, and F. H. Spedding. Sept. 4, 1953. 10p. (ISC-404)

The crystal structure of Sm is rhombohedral; a = 8.996 A, $\alpha = 23° 13'$, Z = 3. The atomic positions are 000, $\frac{2}{3}\ \frac{2}{3}\ \frac{2}{3}$, and $\frac{1}{3}\ \frac{1}{3}\ \frac{1}{3}$. Single-crystal data require a disordered structure where half of the unit cells are rotated 180° about the three-fold axis with respect to the other half. The hexagonal lattice constants are a = 3.621 ± 0.007 A, c = 26.25 ± 0.05 A; Z = 9. The experimental data are explained on the basis of a partially disordered lattice where there is a definite correlation between the two structures. (auth)

6114
Illinois Univ.
THE DISTORTION OF A CRYSTAL BY POINT IMPERFECTIONS. J. D. Eshelby. July 1953. 27p. (NP-4770; Technical Report 9)

The expression $\bar{u} = c\bar{r}/r^3$ (where c is a constant) sometimes assumed for the displacement around a point imperfection (interstitial or substitutional impurity, lattice vacancy) gives a non-zero stress at the surface of the solid. The additional image displacement necessary to insure that this stress vanishes is usually neglected, but may be important. For example, it accounts for from 30 to 50% of the volume change produced by such defects. This and other effects of the image term are discussed. Miller and Russel have pointed out that for a point imperfection near the center of a sphere the apparent volume change deduced from measurements of the x-ray lattice constant is greater than the geometrical volume change. It is shown that the reverse is true when the defect is near the surface, and that for a large number of defects scattered uniformly through the sphere the geometrical and x-ray expansions are equal. This result is true with or without the image term, but to establish the equality of geometrical and x-ray expansions for a body of arbitrary shape the image terms must be included. (auth)

6115
Solid-State and Molecular Theory Group, Mass. Inst. of Tech.
ELECTRONIC STRUCTURE OF SOLIDS. 1. THE ENERGY BAND METHOD. John C. Slater. July 15, 1953. 124p. (NP-4847; Technical Report 4)

The theory of the electronic structure of solids is developed from a wave-equation approach. Self-consistent field methods allow a solution of the Schroedinger equation for the one-electron problem. The resulting solutions give rise to energy-level banding, and the structure of solids is attacked with this analytical tool. (K.S.)

6116
DOMAIN STRUCTURE OF LEAD TITANATE. E. G. Fesenko [Ye. G. Fesenko]. Translated from Doklady Akad. Nauk S.S.S.R. 88, 785-6(1953). 2p. (NSF-tr-64; D-88-785)

$PbTiO_3$ has a tetragonal cell with a = 3.90 A and c = 4.147 A. The refractive index is 2.65. Domains, spontaneously polarized regions, are found in these crystals with linear dimensions close to 100 μ. The domains are unchanged by temperatures up to 400°C, but a further rise in temperature causes a slow reduction in size. In the vicinity of 500°C the domains disappear. If the temperature does not reach 500°C, the domain structure returns to its original form upon cooling. (J.S.R.)

6117
DIFFRACTION OF NEUTRONS BY CRYSTALS IN VIBRATION. Marcos Moshinsky. Rev. mex. fis. 2, 137-54(1953) July. (In Spanish)

The effect that the vibration of the crystal lattice has on the diffraction of the neutrons incident upon it is analyzed. Following the dynamical procedure developed by von Laue for the corresponding electromagnetic problem, the analysis is divided into two parts. In the first, the scattering of neutrons by a vibrating nucleus is discussed with the help of a time-dependent generalization of Fermi's equivalent potential. In the second is discussed the superposition of the scattered waves from all the vibrating nuclei in the lattice, and the differential cross sections for elastic and inelastic scattering by the vibrating crystal are obtained. Under certain assumptions, the scattering of neutrons and of electromagnetic radiation by a vibrating particle shows the resemblance that was predicted intuitively from the phenomenon of diffraction in time. (auth)

ELECTRICAL DISCHARGE

6118
Radiation Lab., Univ. of Calif., Berkeley
ELECTRON LOADING AND HIGH VOLTAGE SPARKING OF METALS IN VACUUM. Harry G. Heard. June 29, 1953. 32p. (UCRL-2252)

Statistical methods were employed to measure relative values of electron loading and spark-over voltage for a large number of unoutgassed electrode materials. Test voltages up to 110 kv were employed in vacuum of the order of 10^{-7} mm Hg. All metals showed a square-root dependence between spark-over voltage and spacing. Electron loading as well as spark-over voltage are shown to be dependent on electrode gap shunt capacity. Electron loading was an exponential function of the applied field. The constants for these empirical relations are given for fixed experimental conditions. Metals are classified separately as to electron loading and voltage-holding capacity. (auth)

6119
Radiation Lab., Univ. of Calif., Berkeley
A CRITERION FOR VACUUM SPARKING DESIGNED TO INCLUDE BOTH R.F. AND D.C. W. D. Kilpatrick. Sept. 4, 1953. 15p. (UCRL-2321)

An empirical relation is presented which represents a boundary between no vacuum sparking and possible vacuum sparking. Metal electrodes and r-f or d-c voltages are used. The criterion fits several orders of surface gradient, voltage, gap, and frequency. Current caused by field emission is considered necessary for sparking, but, in addition, energetic particles are required to initiate a cascade process which increases the field-emission currents to the point of sparking. An elementary cascade process is outlined, but the data upon which it is based are not fully stated. (auth)

6120
ON THE STRUCTURE OF GASEOUS DISCHARGES. Heinz

Raether. Z. angew. Phys. 5, No. 6, 211-17(1953). (In German)

The structure of an electric discharge, from the first ionization build-up to the surge of electrons across the gap, for various sized gaps is analyzed and conclusively demonstrates Townsend structure of ionization. (E.S.)

6121

ON THE MECHANISM OF THE INITIATION OF AN ELECTRICAL GASEOUS DISCHARGE UNDER THE ACTION OF A TRANSVERSE MAGNETIC FIELD IN THE PRESSURE RANGE 10^{-1} TO 10^{-6} MM Hg. R. Haefer. Acta Phys. Austriaca 7, 251-77(1953) Oct. (In German)

A theory is evolved in which the electrical field is inhomogeneous (cylindrical electrodes) and the mean free path is large compared with the "rolling" diameter of the electron's cycloidal path. The ignition characteristic (initial potential as a function of the magnetic induction multiplied by the electrode gap at a given pressure) is calculated and compared with the measurements on A in the pressure range 10^{-1} to 10^{-5} mm Hg. At all points there was agreement between theory and experiment. (E.S.)

6122

THE FIELD EMISSION INITIATED VACUUM ARC. I. EXPERIMENTS ON ARC INITIATION. W. P. Dyke, J. K. Trolan, E. E. Martin, and J. P. Barbour. Phys. Rev. 91, 1043-54(1953) Sept. 1.

It is known that electrical breakdown between metal electrodes can be initiated by field emission. The present work concerns a further study of that initiation process under conditions of excellent vacuum and a clean cathode surface. As the field current density from the single-crystal W emitter is continuously increased, the normal emission is terminated by an explosive vacuum arc. Since this breakdown occurs in less than a microsecond, the experimental observations were obtained by use of pulse electronic techniques. The magnitude of the electric field, current density, and work function at the cathode were simultaneously determined prior to breakdown. From this investigation it has been established that: (1) the vacuum arc was initiated at a critical value of the field current density of the order of 10^8 amp/cm^2; (2) breakdown was predictable and not random; in fact easily recognizable conditions preceding arc formation have been established; at current densities just below the critical value, an electron emission process was observed, which apparently involved both high electric fields and high temperatures; (3) arc formation did not require cathode bombardment by material from the anode or from residual gases; (4) breakdown was independent of the applied microsecond voltage in the range $5 < V < 60$ kv, provided the critical current density was not exceeded; (5) the current during arc exceeded the initiating field current by a factor of at least 100. (auth)

6123

THE FIELD EMISSION INITIATED VACUUM ARC. II. THE RESISTIVELY HEATED EMITTER. W. W. Dolan, W. P. Dyke, and J. K. Trolan. Phys. Rev. 91, 1054-7(1953) Sept. 1.

Electrical breakdown between clean metal electrodes in high vacuum was observed when the field current density at the single-crystal W cathode exceeded a critical value of the order of 10^8 amp/cm^2. At current densities just below the critical value, an electron-emission process was observed which apparently involved both high temperature and high electric field. Calculations are presented for the emitter temperature increase due to the resistive mechanism for both the steady state and the transient solution. Emitter geometries used for the calculations approximated those obtained from electron micrographs of several emitters. The calculations show that the resistive heating was sufficient to melt the emitter at the critical current density, assuming the accepted value of the physical constants for the polycrystalline metal. (auth)

6124

MAGNETOIONIC THEORY OF WEAKLY IONIZED GAS IN THE PRESENCE OF AN OSCILLATING ELECTRIC FIELD AND A CONSTANT MAGNETIC FIELD. Raymond Jancel and Théo Kahan. J. phys. radium 14, 533-40(1953) Oct. (In French)

Based on a method for solving the Boltzmann integro-differential equation, a calculation is presented of the distribution functions in a nonuniformly ionized gas that permits explicit expressions to be given for the magnetoionic conductivity in the presence of an oscillating electric field and a constant magnetic field, for the conductivity tensor, for the dielectric tensor, for the Hall effect, for the deviation of an electron beam, and for a generalization of Langevin's mobility equation. (tr-auth)

ELECTRONS

6125

SECONDARY EMISSION DURING BOMBARDMENT OF A METAL TARGET BY MULTIPLY CHARGED IONS. Yu. A. Dunaev [Dunayev] and I. P. Flaks. Translated from Doklady Akad. Nauk S.S.S.R. 91, 43-5(1953). 3p. (NSF-tr-72; D-91-43)

The secondary emission of electrons was measured for metal targets bombarded by Na, Ca, Ba, Sb, Bi, and Te ions of different charges. In the case of ions of Sb, Bi, and Te, the target was made from the same element as the incident ions. In the case of ions of Na, Ba, and Ca, the target was made of pure Ni. The secondary electron emission increases almost linearly with increasing ion energy. The coefficient of secondary emission for Na^{2+}, Ba^{4+}, Ba^{5+}, Ca^{3+}, Bi^{4+}, Bi^{5+}, Sb^{4+}, Sb^{5+}, and Te^{5+} was much higher than for the other valences. (J.S.R.)

6126

NUMERICAL CALCULATION OF TRAJECTORIES IN CENTERED SYSTEMS OF ELECTRON OPTICS. Pierre Gautier. J. phys. radium 14, 524-32(1953) Oct. (In French)

The proposed method is based on the classical procedure of expressing the derivatives of a differential equation as a function of finite differences. The differential equation of paraxial trajectories in a magnetic lens does not contain the first derivative. This circumstance permits a very rapid method of calculation. The deviation between a paraxial trajectory and the corresponding third-order trajectory is calculated in an entirely analogous manner. A numerical example is treated in detail. In the general case of a field formed by the superposition of an electrostatic field and a magnetostatic field having the same axis of revolution, and in the more limited case of electrostatic lens, a known change of variable permits the elimination of the first derivative in the trajectory equation; the same method of calculation may be used. (tr-auth)

GASES

6127

Naval Research Lab., Univ. of Wis.

THE TEMPERATURE DEPENDENCE OF THE MUTUAL DIFFUSION COEFFICIENT FOR FOUR GASEOUS SYSTEMS. Roger A. Strehlow. Feb. 9, 1953. 20p. (CM-776; AD-7653)

Diffusion coefficients have been measured for the systems He-A, H_2-A, H_2-nC_4H_{10}, and H_2-SF_6 over the temperature range 13 to 150°C. The values were determined by a point-concentration analysis while diffusion proceeded at one end of a Loschmidt-type cell. The analysis was made with a hot-

wire technique and utilized the large difference in thermal conductivity to indicate concentration. The generalized equations for calculating D from an experiment with a Loschmidt-type cell are given as well as an analysis of the errors involved in calculating D from these data. The data were used to calculate binary force constants for the Lennard-Jones potential. The difficulties of calculating Lennard-Jones force constants from experimental viscosity or diffusion data are discussed. (auth)

6128
[California Univ., Berkeley]
AERODYNAMIC FORCES ON A CYLINDER FOR THE FREE MOLECULE FLOW OF A NON-UNIFORM GAS. S. Bell and S. A. Schaaf. Dec. 19, 1952. 16p. (HE-150-110; AD-1910)

6129
Naval Ordnance Lab.
APPARATUS FOR MEASUREMENT OF PVT RELATIONSHIPS OF GASES AT HIGH TEMPERATURES AND PRESSURES: EFFECTS OF CHANGING THE INITIAL OPERATING CONDITIONS. Robert S. Allgaier. June 3, 1952. 26p. (NAVORD-2455)

The behavior of gases undergoing an adiabatic compression cycle is investigated as a function of the initial conditions. The calculations presented are theoretical and approximate and are intended to serve only as a guide to proper use of a compressor designed to produce such a cycle. (auth)

6130
Palmer Physical Lab., Princeton Univ.
RADIO FREQUENCY TRANSITIONS BETWEEN HYPERFINE LEVELS OF ATOMIC HYDROGEN; INVESTIGATION OF THE EFFECT OF GAS COLLISIONS UPON THE DOPPLER BREADTH OF SPECIAL LINES. QUARTERLY REPORT, DECEMBER 15, 1952 THROUGH APRIL 15, 1953. R. H. Dicke. 8p. (NP-4804; AD-9824; Quarterly Report 3)

Additional studies of atomic H formation and transport were made to permit greater control over the conditions prevailing in the resonant cavity. Difficulties developed in the system of electronics used, and a new system to eliminate them was devised. Equipment connected with the new system has been designed and built. Detailed calculations as to the effect of electron exchange in collisions between H atoms were made and confirm previous estimates. (auth)

6131
Naval Research Lab., Univ. of Wis.
THE KINETIC THEORY OF DENSE GASES. C. F. Curtiss. [1953] 49p. (WIS-OOR-3; AD-6699)

An approximate kinetic theory of dense gases is developed. The theory is a modification of the Enskog theory of a dense gas made up of rigid spherical molecules and takes into account the effect of "collisional transfer" of momentum and energy and the effect of the shielding of one molecule by others, but it does not consider the effect of multiple collisions. It is assumed as an approximation that, in a collision between nonrigid molecules, the "collisional transfer" takes place instantaneously at the time of closest approach. Expressions for the coefficients of shear and bulk viscosity and thermal conductivity are obtained in terms of a set of integrals which may be interpreted as generalizations of the "van der Waals' b" or covolume of the molecules. These integrals depend on the nature of the intermolecular potential. (auth)

INSTRUMENTS

6132
David Sarnoff Research Center
ELECTRONIC DEVICES FOR NUCLEAR PHYSICS. QUARTERLY REPORT [FOR] APRIL 1953–JULY 1953. G. A. Morton, R. H. Anderson, P. W. Davison, M. W. Green, M. H. Greenblatt, A. L. Solomon, and A. H. Sommer. 22p. (AECU-2691; Quarterly Report 12)

New research on the properties of photomultipliers and photosensitive materials is reported. Favorable characteristics have been found for $SbCs_3$ and $SbLi_3$ cathodes. Additional color response data are presented for these materials. Current progress on the design of high-gain, high-current photomultiplier anode geometries is outlined, and characteristic curves are given. (For preceding report see AECU-2640.) (K.S.)

6133
Los Alamos Scientific Lab.
INSTRUMENT FOR TESTING LARGE NUMBERS OF PHOTOMULTIPLIER TUBES. [A. Brousseau] [1953] 15p. (AECU-2692; LADC-1467)

An instrument for multiple testing and balancing of large numbers of photomultiplier tubes is described. This testing device allows tube selection based on uniformity of gain, freedom of after-pulses, satisfactory gain stability over a period of time, a fair energy resolution, and low dark-current characteristics. Wiring diagrams for the testing set-up and photographs of the completed assembly are included. (C.H.)

6134
California Univ., Los Angeles
CALIBRATION OF A TEMPERATURE MEASURING DEVICE. Alphonso Ambrosio and Bertram Bussell. Apr. 1951. 42p. (ATI-165261)

The construction and calibration of a particular type of temperature-measuring device is described. This device consists of low melting point alloys built into "band-aid" type patches. The temperature range 117 to 511°F is covered in discrete steps by 14 different alloys. The calibration is made by securing the patch to a piece of sheet Al, irradiating the reverse side of the sheet with photoflood lamps, and checking the pieces of alloy in the patch for melting and fusion. The calibration of the patches led to a comparison scale, against which other patches of this type may be checked to determine maximum temperatures of heated surfaces. This method is useful for approximate answers only. (auth)

6135
Knolls Atomic Power Lab.
A NOTE ON THE PRECISION CALIBRATION OF VARIABLE FREQUENCY OSCILLATORS. C. Mannal. July 10, 1953. 14p. (KAPL-956)

A new method for the precision calibration of variable-frequency oscillators involving the use of Lissajous figures based on a continuous sequence of rational fractions is described. The method requires no auxiliary equipment other than a cathode-ray oscilloscope, is extremely rapid, and highly accurate. Any desired number of interpolation points may be quickly established. A method is given for the rapid selection of appropriate rational fractions. A brief description is also given of a simple oscillator stable to one part in 10^5 per day with a calibration fineness of 0.1 cycle in the 10,000-cycle range. (auth)

6136
Los Alamos Scientific Lab.
DUAL CODING SYSTEM. Stewart I. Schlesinger and Bengt Carlson. July 1953. 25p. (LA-1573)

The dual coding system is a combined fixed-decimal and floating-decimal computing system designed for the IBM electronic data processing machine, type 701. An explanation of when and how to use the machine is given. (auth)

6137
Mound Lab.
BATH CONTROL, STABILITY OF THE TWIN BRIDGE

CALORIMETER, AND THERMAL NOISE. J. R. Parks. Aug. 15, 1951. 24p. (MLM-595)

The problem of precisely measuring microquantities of power of the order of 0.01 cal/hr has been attacked by many experimenters. The Mound Lab. Calorimetry Research Group has attacked the problem from a different point of view. The factors that limit the precise measurement of microquantities of power were considered to be within the calorimeter, the environment of the calorimeter, and in the response of the calorimeter to its environment. The twin-bridge isothermal calorimeter was selected for the study of its sensitivity and its ability to remove from its response the changes in bath temperature. Oil and water baths were studied with respect to their responses to on-off and proportional control. In the study of the third factor it was found that the twin-bridge calorimeter could not remove from its response the random temperature changes of the bath in the vicinity of the calorimeter. This bath "noise" was recorded and analyzed by the use of the autocorrelation function and I.B.M. punch-card calculators. The use of the autocorrelation function was shown to be an excellent tool for developing a "low noise level" bath for a precise measurement of microquantities of power. (auth)

6138

Office of Basic Instrumentation, National Bureau of Standards

PROCEEDINGS OF SYMPOSIUM ON BARIUM TITANATE ACCELEROMETERS HELD IN WASHINGTON, D. C., MAY 14-15, 1953. Thomas A. Perls, comp. Aug. 1953. 228p. (NBS-2654)

This symposium, the sixth of a series on basic instrumentation developments, was attended by more than 250 scientists and engineers representing 67 industrial and university laboratories as well as 44 U. S. Government agencies and four foreign government agencies. Prepared papers were presented and discussions held concerning the following: (1) various properties, stability, and methods of polarization of Ba titanates, (2) design factors and performance tests of Ba-titanate accelerometers, and (3) instrumentation associated with the accelerometers. The texts of the prepared papers as well as the material from the discussions are presented. (L.M.T.)

6139

Office of Basic Instrumentation, National Bureau of Standards

AN INTEGRATING AND DIFFERENTIATING BAR-MAGNET VELOCITY METER FOR USE IN BALLISTOCARDIOGRAPHY. Thomas A. Perls and Charles W. Kissinger. Sept. 1953. 31p. (NBS-2733)

An integrating and differentiating bar-magnet velocity meter is described. Design criteria are presented for integrators and differentiators to meet given specifications of frequency response. In the design of the differentiator, use is made of a small amount of resonance magnification in a suitably damped series-resonant circuit. Test procedures are described in detail for determinations of frequency response, sensitivity, and linear range of the instrument. Detailed examples are given of sensitivity adjustment and installation procedures for use of this instrument in ballistocardiography. (auth)

6140

Colorado Univ.

DESCRIPTION OF A NEW DETECTOR SYSTEM FOR LUMINESCENCE IN THE INFRARED; ENERGY DISTRIBUTION IN LUMINESCENCE SPECTRA OF ORGANIC COMPOUNDS. Bruno Witte, Inge Witte, and Frank E. E. Germann. [1953] 21p. (NP-4721; Technical Report 1)

The detector system for luminescence in the infrared consists of the detector, the preamplifier, the driver and relay, the integrator and postamplifier, and the power supply. Each is discussed in detail, and the circuit diagrams are given. (J.S.R.)

6141

Georgia Inst. of Tech., State Engineering Experiment Station

INVESTIGATION OF FREQUENCY CONTROL ABOVE 150 MC, PROGRESS REPORT, SEPTEMBER 30, 1952 TO DECEMBER 1, 1952. Vernon Crawford, James C. Hogg, Jr., and William H. Bradley. 32p. (NP-4806; Progress Report 7; AD-4995)

A quarter-wave coaxial resonator has been constructed and tested. While the performance of this unit with respect to sensitivity to vibration is superior to previously constructed half-wave units, its temperature coefficient of frequency is inferior, being approximately three parts per million per °C. Responses from the nuclear quadrupole resonances of $NaBrO_3$ have been observed at 150 and 179 Mc. These responses have the highest signal-to-noise ratio of any responses observed. Passive measurements of the amplitude of these responses have been attempted, but no data are available as yet. A modified spectrometer and sample holder promises to enable observation of nuclear quadrupole resonance up to 300 Mc. A correlation between quadrupole coupling constants and electronegativity difference has been observed. This gives a basis for prediction of the frequency of hitherto unobserved resonances. (auth)

6142

Naval Research Lab.

PORTABLE PRECISION FREQUENCY METER. PART 3. SIMPLIFIED DIRECT-READING METER. G. K. Jensen and J. E. McGeogh. Mar. 31, 1953. 22p. (NRL-4111)

A modification of the originally proposed frequency meter (NRL-3527), which contained three major components consisting of internal frequency generator, mixer, and comparison circuits provides significant improvements in two or the three components. In the internal frequency generator the major change is to provide a 10:1 frequency range on each of four bands which now cover a total range of 100 kc to 1000 Mc and to provide additional decade frequency selector controls which enable frequency adjustment in very small steps, each of crystal accuracy, to approach continuous tuning. Direct decade frequency reading from the front panel without the frequency equation and elimination of the necessity for an accurately read difference frequency have been achieved by the above changes. Principles of the internal frequency generator have been proved by the successful completion of the direct reading four-decade divider and by operation of the afc loop. (auth)

6143

Telecommunications Research Establishment (Great Britain)

COMPONENTS FOR TRANSISTORS. G. W. A. Dummer and A. L. Gregory. Nov. 5, 1952. 4p. (TRE-TN-174)

6144

ON THE RESOLVING POWER OF AN ELECTRON OBJECTIVE OF THE IMMERSION TYPE. G. V. Spivak and E. M. Dubinia. Translated from Doklady Akad. Nauk S.S.S.R. 88, 673-5(1953). 3p. Name on doc.: Ye. M. Dubinina. (NSF-tr-57; D-88-673)

The resolving power of an immersion-type electron microsope is improved by applying a square-wave voltage pulse to the cathode objective. By choosing the width of the applied pulse to be of the same order as the build-up time required for sparkover, voltages of 5 to 7 times that of the d-c case can be applied without break-down. Several factors influencing break-down and an analysis of the method are also discussed. (K.S.)

6145
MEASUREMENTS OF MELTING POINTS OF METALS UNDER EXTREMELY HIGH PRESSURES. V. P. Butuzov, M. G. Gonikberg, and S. P. Smirnov. Translated from Doklady Akad. Nauk S.S.S.R. 89, 651-3(1953). 3p. (NSF-tr-76; D-89-651)

A method is described for measuring the melting points of metals under very high pressure. An electrical heating device is placed inside a high-pressure vessel. The method is based on inferring the temperature of solidification of the molten metals from the leveling of the temperature curve of the cooling melt. (C.H.)

6146
FIRST RESULTS OF EXPERIENCE WITH AN ION SOURCE HAVING ANNULAR EXTRACTION. J. Sommeria. J. phys. radium 14, 555(1953) Oct. (In French)

Performance of an ion source giving an annular H ion beam is reported. For a magnetic field of 1500 gauss, a H pressure of 1.5×10^{-3} mm of Hg, a chamber-filament voltage of 450 v, and an extraction potential of 12,000 v, the ion current is 9 ma. After modifying the ion optics, an ion current of 20 to 25 ma is expected. (G.Y.)

6147
HIGH-FREQUENCY ION SOURCE FOR A 250-KV NEUTRON GENERATOR. Jean de Beauregard. J. phys. radium 14, 547-8(1953) Oct. (In French)

An ion source for an accelerator providing a 250-μa beam of 150-kv deuterons to a Li-D neutron generator is described. The D is ionized by high-frequency oscillations. A Pd osmoregulator to control the low flow rate (10 to 15 cc/hr) of D is described. (G.Y.)

ISOTOPES

6148
FLUORINE-18: PREPARATION, PROPERTIES, USES. Richard B. Bernstein and Joseph J. Katz. Nucleonics 11, No. 10, 46-51(1953) Oct.

F^{18} is available by a number of convenient nuclear syntheses, opening up a wide potential for tracer studies. The authors discuss the most practical methods for preparing the nuclide and working with it to study a wide variety of chemical problems. (auth)

ISOTOPE SEPARATION

6149
New York State Coll. for Teachers
CONCENTRATION OF NITROGEN 15 BY CHEMICAL EXCHANGE BETWEEN NO_2 AND NO; SEMI-ANNUAL PROGRESS REPORT FOR PERIOD FROM JUNE 15, 1952 TO JANUARY 15, 1953. W. Spindel, E. H. MacLaren, R. H. Johns, R. P. Lanni, G. W. Reynolds, O. E. Lanford. [nd] 9p. (AECU-2656)

The proposed method would consist of flowing liquid NO_2 down through a packed column, chemically converting the NO_2 into NO at the bottom end, and passing the NO up through the column. This should lead to a concentration of the N^{15} at the bottom end of the column. The primary problem is the reduction of NO_2 to NO without the formation of N_2 as a side product. Activities for the period consisted of constructing and calibrating a mass spectrometer for isotope analysis and investigating Cu and Zn as reducing agents for NO_2. Metallic reducing agents do not appear promising, and future attempts will be made to reduce the NO_2 either by electrolysis or with liquids. (L.M.T.)

6150
THE RAPID SEPARATION OF He^3 FROM He^4 BY THE "HEAT FLUSH" METHOD. T. Soller, W. M. Fairbank, and A. D. Crowell. Phys. Rev. 91, 1058-60(1953) Sept. 1.

A practical method is described for separating the He^3 which occurs in well He from the liquefied mixture using the "heat flush" technique. Approximately 2 l/hr of liquid can be processed, a rate considerably in excess of any previous separations. When the separated isotope is finally withdrawn at room temperature, the concentration of He^3 is approximately 0.5%. This concentration corresponds to an enrichment factor of 3×10^4, which is an order of magnitude greater than enrichment factors reported previously in the literature. (auth)

MASS SPECTROGRAPHY

6151
MASS SPECTROMETRIC DETERMINATION OF APPEARANCE POTENTIALS OF MOLECULES. H. Neuert. Angew. Chem. 65, 454-9(1953) Sept. (In German)

Examination of the processes of dissociation of molecules on electronic impact presents a wide field for the application of mass spectrometry, especially those processes in which charged dissociation fractions occur. The various possibilities of the formation of negative and positive ions in the dissociation of simple molecules by electronic impact are shown, and the processes are considered regarding their energy balance. Particularly revealing is the determination of that electron energy causing dissociation in which one type of ion appears in the mass spectrometer for the first time (appearance potential). Several processes used for an exact determination of these potentials are discussed and compared. (tr-auth)

6152
AN ATOMIC MASS STUDY OF NUCLEAR SHELL STRUCTURE IN THE REGION $28 \leq n \leq 50$ AND $28 \leq Z \leq 40$. Benjamin G. Hogg and Henry E. Duckworth. Can. J. Phys. 31, 942-53(1953) Sept.

New mass-spectrographic masses are reported for some of the isotopes of Ga, Ge, As, and Se. These results are combined with previously reported atomic-mass data in order to study atomic-mass trends in the region $28 \leq n \leq 50$ and $28 \leq Z \leq 40$. The only pronounced mass effects which occur in this region are those associated with 28 and 50 nucleons. No extra stability was found which could be associated with the filling of the $f_{\frac{1}{2}}$, $p_{\frac{3}{2}}$, and $p_{\frac{1}{2}}$ subshells. A list of mass values used in this study is included. (auth)

MATHEMATICS

6153
Ballistic Research Labs., Aberdeen Proving Ground
MATRIX INVERSION BY PARTITIONING. Mark Lotkin and Russell Remage. July 1952. 53p. (BRL-823)

The inversion of matrices may be accomplished by a variety of methods. The purpose of this report is the examination of one of these methods with regard to inherent accuracy and suitability for high-speed computing machinery. After giving brief outlines of the partitioning method and a feasible iteration procedure, the scaling and digitalizing problems, necessary steps in the translation from mathematical theory to computational practice, are carefully described and analyzed. It is found that the proposed method will yield sufficiently accurate inverses in most cases of practical interest. (auth)

6154
Ballistic Research Labs., Aberdeen Proving Ground
AN INTEGRATION PROCEDURE OF HIGH ACCURACY. Mark Lotkin. Nov. 1952. 22p. (BRL-838)

Three new formulas for the evaluation of integrals of tabulated functions are derived. Their accuracy is found to be on par, respectively, with that of such well-known rules as Simpson's, Weddle's, and others. However, the inherent simplicity of these new formulas indicates a definite superiority over most of these other formulas,

both from the viewpoint of computation by hand as well as by modern high-speed machinery. (auth)

6155

Idaho Operations Office, AEC

THE APPLICATION OF TECHNIQUES OF SEQUENTIAL ANALYSIS TO AUDIT PROCEDURES. Miller N. Hudson, Jr. Sept. 25, 1953. 47p. (IDO-10022)

The application of Wald's technique of sequential analysis to auditing procedures is developed. An example of the application is given, based on actual field experience. The concepts of "Minimum Inspection Number" and "Multiple Risk Patterns" are presented along with considerations of certain nonstatistical aspects such as the establishment of risk functions and acceptability criteria. (auth)

6156

Research Lab. of Electronics, Mass. Inst. of Tech.

LECTURES ON COMMUNICATION THEORY. D. Gabor. Apr. 3, 1952. 50p. (NP-4874; Technical Report 238)

6157

APPROXIMATE SOLUTION OF HEITLER'S INTEGRAL EQUATION. S. N. Biswas. Phys. Rev. 91, 1026-7(1953) Aug. 15.

A consistent method for the solution of the Heitler integral equation in the theory of radiation damping in scattering processes has been developed, based on the idea of the numerical solution of Fredholm's equation by an iterative procedure. This method gives a closer approximation if an approximate solution is already known. (L.T.W.)

6158

THE THEORY OF FINITE DISPLACEMENT OPERATORS AND FUNDAMENTAL LENGTH. B. T. Darling and P. R. Zilsel. Phys. Rev. 91, 1252-6(1953) Sept. 1.

The general finite-displacement operator in an n-dimensional complex continuum is defined as an arbitrary superposition of exponential Taylor operators (a Taylor operator yields a Taylor's series). On restriction to the space-time continuum and four-dimensional time-like intervals of constant length ω, the corresponding finite displacement operator may be considered as an ordinary function of the operators u_σ (the partial derivative with respect to x_σ) and must satisfy a Klein-Gordon type equation in u space. This equation possesses relativistic invariant and four-vector solutions that in the limit $\omega \to 0$ reduce to 1 and u_σ, respectively. These operators are combined with the Compton wavelength k and the Dirac or Duffin γ_σ, respectively, to produce a relativistically invariant correspondence type finite-displacement operator generalization of the Dirac-Duffin equation. If the fields are charged, the electromagnetic potentials may be introduced in a manner which leaves the mass spectrum unaltered. The relationship to other nonlocal theories and to the reciprocity theory of Born is briefly considered. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

6159

Phillips Petroleum Co., Atomic Energy Div.

A PRELIMINARY REPORT ON THE MTR CRYSTAL SPECTROMETER. J. E. Evans. Aug. 19, 1953. 15p. (IDO-16120)

A neutron crystal spectrometer has been placed in operation at the MTR. It is equipped for remote manual and automatic operation. By use of the 240 planes of a $^3/_{16}$-in. slab of natural NaCl in transmission, counting rates of 500,000 cpm at 0.07 ev, 12,000 cpm at 1 ev, and 3,000 cpm at 10 ev have been obtained. At these counting rates, special attention must be given to the conditions under which the BF_3 counters are operated. In calibration runs, the total cross sections of In, Ta, and Ti have been measured from 0.05 to 100 ev. (auth)

6160

Livermore Research Lab., Calif. Research and Development Co.

COUNTING EFFICIENCIES FOR SODIUM IODIDE CRYSTALS. P. W. McLaughlin and G. D. O'Kelley. Issued Sept. 1953. 22p. (MTA-40)

The photoelectric yield of a 1-in. Na iodide crystal was calculated for the energy region 0 to 1.3 Mev. This calculation includes a correction for secondary absorption within the crystal. Photoelectric yields at several different energies were measured by integrating the photoelectric peaks obtained from a scintillation spectrometer. These integrated counts were then compared with the known disintegration rates of the samples studied. The experimentally determined yields show satisfactory agreement with the calculated values. (auth)

6161

Atomic Energy Project, Univ. of Rochester

MEASUREMENT OF X-RAY BEAM QUALITY BY THE USE OF METAL WALL TO "AIR"-WALL CHAMBER RATIOS. Adrian H. Dahl. Apr. 30, 1953. 151p. (UR-250)

A method of x-ray quality evaluation based on relative yield of secondary electron emission from metals is described in detail in this report. The metals were used as the electrode material of cavity ionization chambers. Modified Victoreen pocket chambers and Victoreen Minometer were used as the measuring system. Theoretical curves of relative secondary electron yield versus monochromatic photon energy are presented for Al to "air"-wall, Cu to "air"-wall, and Ta to "air"-wall chamber pairs. These curves are based on the Bragg-Gray principle and the most recently available x-ray-absorption data. Experimentally obtained ratios of readings from chambers exposed to carefully collimated and quality evaluated x-ray beams are compared to the theoretical curves. The effect of metal electrode thicknesses and the size of the air cavity are also demonstrated. The experimental results agree with the theoretical values for effective energies above 60 kev as long as x-ray beams of narrow photon energy distribution are used (heavily filtered). Using a pressed-wood phantom of the approximate dimensions of the abdominal region of a 170-lb man, a study is presented of the variation of effective energy with depth into the phantom man when exposed separately to three different qualities of heavily filtered x-ray beams. The maximum ratio of secondary to primary intensity in the phantom man exposed to the 760-kev beam (1.5 to 1) was less than that found in the 175-kev beam (6.5 to 1). However, the maximum reduction in the effective energy of the x-ray beam was proportionately greater in the 760-kev beam (to 300 kev) than in the 175-kev beam (to 90 kev). (auth)

6162

Atomic Energy Project, Univ. of Rochester

A FLEXIBLE AURAL INDICATING ALPHA SURVEY INSTRUMENT. R. E. Vosteen. June 3, 1953. 32p. (UR-270)

Design is reported of an instrument which utilizes aural indication only for α measurement. It permits the use of any one of three types of α detectors; namely, an air proportional probe, a thin-window GM probe operating in the proportional region, or an α scintillation probe. It is simple and dependable in operation and circumvents the artifacts associated with the "Poppy" type instrument. (auth)

6163

SCINTILLATION COUNTERS USING LIQUID LUMINESCENT MEDIA FOR ABSOLUTE STANDARDIZATION AND RADIOACTIVE ASSAY. E. H. Belcher. J. Sci. Instr. 30, 286-9 (1953) Aug.

A scintillation counter designed for the standardization

of radioactive isotopes by 4π β counting and for the radioactive assay of small biological samples by γ counting is described. The instrument uses a liquid luminophor in conjunction with an uncooled end-window photomultiplier tube. Details are given of performance with various commonly used radioactive isotopes. (auth)

6164

ELIMINATION OF DEAD-TIME CORRECTIONS IN MONITORED GEIGER-COUNTER X-RAY MEASUREMENTS. J. N. Eastabrook and J. W. Hughes. J. Sci. Instr. 30, 317-20(1953) Sept. (cf. NSA 7-1751)

A circuit is described for use with Geiger-counter spectrometers which employ a second Geiger counter to monitor the x-ray output. It allows neither counter to record while either is quenched, and thus ensures that the ratio of counts recorded is equal to the ratio of quanta received and is independent of the quench times, the mean x-ray output, and the x-ray output waveform. The same principle should be applicable to other methods of monitoring. The circuit described also suppresses the background counts for the fraction of the cycle during which a self-rectified x-ray tube produces no characteristic radiation. (auth)

6165

A PRESSURIZED γ-RADIATION MONITOR FOR USE IN INFLAMMABLE ATMOSPHERES. J. B. Marsh, J. F. Hogg, and R. S. Cambray. J. Sci. Instr. 30, 302-4(1953) Sept.

A γ-radiation monitor using an air-filled ionization chamber and designed for use in a chemical process plant handling highly inflammable solvents is described. The amplifier and probe unit is flushed with compressed air before the apparatus is switched on, and during operation a positive internal air pressure is maintained. Results of a test with radioactive A^{41} gas show that the flushing is adequate. (G.Y.)

6166

A SPARK COUNTER WITH CYLINDRICAL SYMMETRY. Théo Muller, Michel Croissiaux, and Serge Gorodetzky. J. phys. radium 14, 554(1953) Oct. (In French)

A Rosenblum-type spark counter in which the anode is a W wire 0.1 mm in diameter situated along the axis of a Cu cylinder (cathode) of 10-mm interior diameter was filled with air or air containing 0.25, 0.50, 0.75, or 1% CO_2. A well-collimated jet of α particles penetrated the counter parallel to the axis and at various radial distances from it. Curves of counting rate vs. distance are plotted. The 1% CO_2 atmosphere gave the highest counting rate, large effective volume, and uniform sensitivity throughout the counter. (G.Y.)

6167

SPECTROMETER FOR FAST NEUTRONS AND THE NEUTRON SPECTRUM OF Ra α + Be. Ulrich Schmidt-Rohr. Z. Naturforsch. a8, 470-9(1953) Aug. (In German)

A spectrometer for neutrons of 2- to 25-Mev energy is described. It consists of a H- or CH_4-filled ionization-chamber telescope. The energy distribution of recoil protons is measured with a coincidence-anticoincidence arrangement and is recorded photographically with a momentum spectrograph. By photometric measurements the neutron spectrum can be obtained in the form of continuous differential curves. The apparatus measures simultaneously all energies within a given energy range, which can be determined by the pressure in the camera. The spectrum is not affected by neutron intensity variations from the source. The average resolution width of the spectrometer is ~300 kev for not-too-high energies; it is determined essentially by amplifier noise. The spectrum of the fast neutrons from a Ra-Be source has been studied with and without Pb filters. It shows the same features expected from the incompletely known nuclear data. An observed structure is attributed to anisotropy of the angular distribution in the center-of-gravity system and to structure in the excitation function. Pb absorbers shift the center of the spectrum toward lower energies. (tr-auth)

6168

GAMMA-RAY INTENSITY MEASUREMENTS BY MEANS OF A NaI(Tl) SCINTILLATION SPECTROMETER. M. J. Sterk and A. H. Wapstra. Physica 19, 669-70(1953) July.

Three factors which must be considered in the calibration of NaI(Tl) scintillation spectrometers by means of the photopeak areas in the scintillation spectrum are briefly discussed. These are: (1) determination of the γ absorption coefficient; (2) dependence of the relative efficiency for counting on the distance between the source and crystal; and (3) the ratio of the areas of the photopeak and its escape peak for energies >150 kev, where the influence of the Compton effect becomes noticeable. (L.M.T.)

6169

ON THE THEORY OF THE SPARK COUNTER. F. Bella and C. Franzinetti. Nuovo cimento (9) 10, 1335-7(1953) Sept. 1. (In English)

The behavior of a spark counter is explained by Loeb and Meek's theory of the mechanism of the electric spark. (G.Y.)

6170

ON SPARK COUNTERS. F. Bella, C. Franzinetti, and D. W. Lee. Nuovo cimento (9) 10, 1338-40(1953) Sept 1. (In English)

Spark counters, consisting of two parallel metal plates separated by ~2 mm and enclosed in a Pyrex envelope, have been built to evaluate their advantages and disadvantages. The best filling mixture was argon at 34 cm Hg and alcohol at 4 cm Hg. These counters have a time resolution of 10^{-9} sec, the position of a point on the track of an ionizing particle can be localized to 1 mm^3, the output pulse is several hundred volts, the plateau is ~1000 v, the efficiency can be made to depend strongly on the direction of incidence, and the life is longer than expected. The temperature sensitivity is such that these counters can be used only in the range +10 to +40°C. It appears that spark counters can be used for experiments in cosmic rays and nuclear physics; they are particularly valuable when good definition in both time and space is required. (G.Y.)

6171

AUTOMATIC SAMPLE CHANGER AND RECORDER FOR DIPPING COUNTERS. B. P. McKay and D. B. Zilversmit. Nucleonics 11, No. 10, 58-60(1953) Oct.

The apparatus described utilizes a turntable equipped with 41 sample wells on the periphery, each being separated by $^3/_{16}$-in. steel shielding plus the plastic walls of the wells. Radioactive samples are added dropwise to a $2^1/_2$- x $1^3/_4$-in. Al foil which has been cupped by a press so as to fit in the wells. A Victoreen 1B85 Geiger tube is mounted on a lever mechanism so as to dip from one well into the next as the turntable rotates. The sample changer is used in conjunction with a Tracerlab Autoscaler, which is set on automatic for counting a preset number of counts, and the time for each sample is printed on a Simplex printing timer. A schematic circuit diagram of the apparatus is presented. (auth)

6172

DETERMINATION OF THE GAMMA RAY SENSITIVITY CURVE FOR PHOTOGRAPHIC EMULSIONS. L. Argiero. Nuovo cimento (9) 10, 1035-9(1953) Aug. 1. (In Italian)

Sensitivities of 14 types of "Ferrania" photographic films to Ra and Co^{60} γ radiation have been measured with their relative errors. The range of sensitivities to be used for protective dosimetry has been determined for each case. (auth)

6173

RADIOPHOTOLUMINESCENCE DOSIMETRY SYSTEM OF THE U. S. NAVY. James H. Schulman, William Shurcliff, Robert J. Ginther, and Frank H. Attix. Nucleonics 11, No. 10, 52-6(1953) Oct.

The DT-60/PD dosimeter utilizes a $\frac{3}{4}$- x $\frac{3}{4}$- x $\frac{3}{16}$-in. block of Ag-activated phosphate glass encased in a circular ethyl cellulose locket $1\frac{1}{2}$ in. in diam. and $\frac{1}{2}$ in. thick. It has a range of 10 to 600 r, and response is linear and independent of dose rate up to at least 170 r/min. Two fluorimeters in which the DT-60/PD fits have been developed, one for laboratory, and one for field use. Circuit diagrams are presented for these fluorimeters, and discussions of their operation are included. Three different types of temperature effects to which the DT-60/PD's are subject are discussed. (L.M.T.)

6174

MONITORING OF WATER FOR FISSION-PRODUCT CONTAMINATION. W. R. Loosemore. Nucleonics 11, No. 10, 36-40(1953) Oct.

A low-voltage G-M counter has been designed to monitor water contaminated with fission products in the range 5×10^{-4} to 0.5 μc/ml if the sample is diluted up to a maximum of ten times its original volume. The counter is intended for use with a portable contamination meter (type 1092D) designed at A.E.R.E. The circuit employs cold-cathode tubes operating a meter with a full-scale reading equivalent to 350 counts/sec. The meter scale is roughly logarithmic, allowing measurements over a range 0.1 to 10 mr/hr. (auth)

6175

FAST AND SIMPLE γ-RAY SCINTILLATION SPECTROMETER. Gerald J. Hine. Nucleonics 11, No. 10, 68-9(1953) Oct.

The γ scintillation spectrometer described utilizes the usual NaI(Tl) crystal and 5819 photomultiplier. The triggered pulses are displayed on the screen of a Tektronix 513D oscilloscope, using a sweep time of 0.1 μsec/cm. Instead of employing a photographic method for pulse-height analysis, the light intensity distribution on the screen is measured directly by a photoelectric cell. For this purpose a densitometer, whose output is measured by a Weston recording potentiometer, is employed. The pulse spectrum is displayed on the oscilloscope screen so that all pulses have a horizontal section of at least 1 cm in width at the vertical center axis of the screen. The light produced by those pulses is channeled into the photoelectric cell through a lucite rod. The amplifier gain is adjusted so that the complete pulse spectrum is spread out beyond the sensitive part of the oscilloscope screen. When the motor-driven vertical-positioning control is activated, the complete spectrum moves slowly across the screen and is recorded. Pulse-energy spectra taken for Hg^{203} and I^{131} are shown. (L.M.T.)

6176

APPLICATION OF THE THEORY OF WILKINSON TO GEIGER-MUELLER COUNTERS WITH EXTERNAL CATHODES. Daniel Blanc and Henri Zyngier. Compt. rend. 237, 38-41(1953) July 6. (In French)

Application of Wilkinson's equations (Phys. Rev. 74, 1417(1948)) to external-cathode counters established that the difference in potential between the internal and external surfaces of the glass, as well as the charge per count, is proportional in the first approximation to the overvoltage. From this can be deduced an indirect method for measuring the resistance of the glass. (tr-auth)

6177

LONG LIFE GEIGER COUNTERS. Harold Sherman and James R. Heirtzler. J. Sci. Ind. Research (India) A12, 370-2(1953) Aug.

Brief descriptions of the principal types of G-M counters and their properties are given. The life of an organic-vapor counter is limited to 10^{10} counts, which may be attained after a few months' operation at moderately high counting rates. A practically infinite-lifetime counter can be made using the halogen gases, but this type of counter has definite disadvantages. Whether or not a halogen counter can be used depends on the type of experiment contemplated. Ammonia-filled counters lack the good characteristics of the shorter-lifetime organic-vapor counters and yet do not quite have the infinite lifetime of the halogen-quenched counters. (G.Y.)

6178

BROMINE-FILLED COUNTERS. R. Richard Foy. Rev. mex. fis. 2, 75-8(1953) Apr. (In Spanish)

A counter tube 2.34 cm in diameter in which the cathode is made of Monel metal and the anode is a W wire 2.5 mm in diameter has been constructed. The counters are filled with Br vapor at low pressure. Their most important property is the ability to give 15-v rectangular pulses lasting 2×10^{-4} sec at 380 v. Their use in a portable radiation detector notably improves the sensitivity and permits simplication in the construction of the high-voltage source. (tr-auth)

6179

OBSERVATIONS ON THE HISTOCHEMICAL REDUCTION OF PHOTOGRAPHIC EMULSION IN RADIOAUTOGRAPHY. Newton B. Everett and Barbara S. Simmons. Anat. Record 117, 25-36(1953) Sept.

Recent attempts to demonstrate by radioautography the specific localization of low concentrations of radioisotopes in rat tissues have emphasized the likelihood of misinterpretation due to histochemical fogging of photographic emulsions. A variety of normal rat tissues, fixed variously, have been shown to reduce photographic emulsions in a way that simulates reduction by β particles. This reduction is not prevented during long exposures by coating the tissue sections or smears with nitrocellulose, Duco cement, silicon, Geon resin, or Formvar. The results indicate that these reducing substances diffuse from the tissues through the coating materials into the photographic emulsion. Exposure of the tissue sections to large volumes of water prior to mounting was the most effective method employed in preventing this reduction. Water-soluble reducing substances are implicated in the chemical reduction since the reducing properties were shown to reside in lyophilized water extract of the tissue. Evidence is presented that for the tissues used the sulfhydryl groups are not primarily responsible for the reduction. (auth)

6180

EVALUATION OF COUNTER-TUBE MEASUREMENTS. I. H. Pupke. Arch. tech. Messen 209, 135-8(1953) June. (In German)

If particles or photons fall on a counter tube, the true number and the recorded number of incident particles or quanta do not correspond, and corrections have to be made to make up for the imperfections of the instruments. Conclusions are drawn from the counting rate concerning the magnitude and presence of such quantities as intensity of radiation, directional distribution, disintegration constant, and absorption coefficient and concerning the statistical independence of the counts. A procedure is given for finding the desired physical relationships from measurements. 91 references. (E.S.)

MESONS

6181

Radiation Lab., Univ. of Calif., Berkeley

THE DEPENDENCE OF NEGATIVE PION PRODUCTION

ON NEUTRON NUMBER. Walter F. Dudziak and Ryokichi Sagane. [Aug. 1953] 5p. (UCRL-2304)

Pion production from proton collisions with Ag, Al, Be, C, Cu, and Pb nuclei indicates a production yield dependence on $N^{2/3}$, where N is the number of neutrons in the nucleus. (K.S.)

6182

Radiation Lab., Univ. of Calif., Berkeley

DEPENDENCE OF POSITIVE PION PRODUCTION CROSS SECTIONS ON ATOMIC NUMBER AT LOW ENERGIES. Ryokichi Sagane and Walter F. Dudziak. Sept. 8, 1953. 5p. (UCRL-2317)

Targets of Be, C, Al, Cu, Ag, and Pb were bombarded with the 340-Mev deflected proton beam of the synchrocyclotron. Positive pions with T = 27 Mev and 12.5 Mev were detected with Ilford C-2 nuclear emulsions. A tendency for variation of π^+ production with atomic number as the π^+ energy is lowered is revealed. (J.S.R.)

6183

CROSS SECTION OF THE $P(\pi^+,2\pi^+)N$ REACTION NEAR THE THRESHOLD. Bernard d'Espagnat. Compt. rend. 237, 139-41(1953) July 15. (In French)

The G matrix element calculated in a previous note (Compt. rend. 237, 26-8(1953)) is introduced into the Heitler equation of the $P(\pi^+,2\pi^+)N$ cross section. The latter is solved, giving, within the limits of the approximation used, an expression for the cross section. (tr-auth)

6184

π-NUCLEON SCATTERING AND THE NUCLEON$(\pi,2\pi)$NUCLEON REACTION. Bernard d'Espagnat. Compt. rend. 237, 26-8(1953) July 6. (In French)

The noncovariant method proposed by Dyson for the investigation of π-nucleon elastic scattering is extended to the reaction $\pi^+ + P \rightarrow N + \pi^+ + \pi^+$ in the vicinity of the threshold. The Goldberger G matrix element is calculated. (tr-auth)

6185

IONIZATION ENERGY LOSSES OF RELATIVISTIC μ MESONS IN GASES. J. E. Kupperian, Jr., and E. D. Palmatier. Phys. Rev. 91, 1186-91(1953) Sept. 1.

By means of proportional counters the ionization energy losses in gases of μ mesons of several high-energy groups have been compared with the loss for mesons at minimum ionization. It is shown that, in a normal proportional counter and Geiger counter telescope arrangement as was used in this work, the effects of locally generated showers and counter-wall-generated secondary electrons tend to mask the increase in ionization loss accompanying increasing μ-meson energy. When such effects are considered, the theoretical rise as predicted by the Bethe-Bloch-Williams theory is confirmed. (auth)

6186

ESTIMATION OF THE SHAPE PARAMETER OF THE ENERGY SPECTRUM OF THE μ MESON DISINTEGRATION ELECTRONS. Jacqueline Jouvin. Compt. rend. 237, 153-5(1953) July 15. (In French)

With the aid of an adaptation of Michel's theoretical equation for the spectrum of the μ meson disintegration electrons to experimental conditions for measuring the energies by multiple scattering, the author estimates the parameter ρ and evaluates its precision. (tr-auth)

6187

PHOTOPRODUCTION OF MESONS IN ATOMIC NUCLEI. Walter Thirring. Helv. Phys. Acta 26, 465-88(1953) Sept. 15. (In German)

The photoproduction of mesons in nuclei is studied without reference to any meson theory, using only the empirical data on photoproduction of mesons in individual nucleons and on the absorption of mesons in nuclei. The available experimental material is satisfactorily explained by the assumption of a gaussian momentum distribution of nucleons within the nucleus. (tr-auth)

6188

RECENT EXPERIMENTAL RESULTS ON S PARTICLES. H. Bridge, H. Courant, H. DeStaebler, Jr., and B. Rossi. Phys. Rev. 91, 1024(1953) Aug. 15.

In an examination of recent cloud-chamber films, several additional examples of S particles have been observed which throw light on the mode of decay of these particles. Out of 20 examples of S particles, only four contained electron cascades. Although photons are produced in the decay of some S particles, it is considered unlikely that the decay process always give rise to photons of energy greater than 150 Mev. (L.T.W.)

6189

THE SPECTRUM AND HALF-LIFE OF THE κ MESON. J. P. Davison. Phys. Rev. 91, 1020-1(1953) Aug. 15.

The variation of half life with rest mass of the κ meson is plotted for two modes of decay, $\kappa^\pm \rightarrow \mu^\pm + 2\nu$ and $\kappa^\pm \rightarrow e^\pm + 2\nu$. The half life of the $\kappa \rightarrow \mu + 2\nu$ mode associated with a rest mass of 940 m_e is 1.63×10^{-9} sec. The end point for the $\kappa \rightarrow \mu + 2\nu$ decay is 145 Mev, while that for the $\kappa \rightarrow e + 2\nu$ mode is 240 Mev. (L.T.W.)

6190

POSITIVE PHOTOMESONS FROM HYDROGEN AT 0°. Nelson Jarmie, Gordon W. Repp, and R. Stephen White. Phys. Rev. 91, 1023-4(1953) Aug. 15.

H_2 gas has been bombarded in a high-pressure, low-temperature target by 322-Mev bremsstrahlung from the Berkeley synchrotron to produce π^+ mesons at $0 \pm 4°$ to the beam. Data have been obtained for a photon energy of 278 ± 4 Mev. The absolute differential cross section in the center-of-mass systems for the reaction $\gamma + p \rightarrow \pi^+ + n$ is 6.2×10^{-30} cm^2 $sterad^{-1}$ $quanta^{-1}$ $proton^{-1}$. A total cross section of $\sigma(278 \text{ Mev}) = (2.5 \pm 0.5) \times 10^{-28}$ cm^2 is obtained. (L.T.W.)

6191

INTERACTION MEAN FREE PATH AND CHARGE EXCHANGE OF THE π-MESONS. G. Salvini. Nuovo Cimento (9) 10, 1018-34(1953) Aug. 1. (In English)

The nuclear properties of the charged π mesons of high energy (kinetic energy between 200 and 1000 Mev) have been studied by observing the interactions in C and Pb of the fast secondary particles (shower particles) emitted in cosmic-ray nuclear events. The interactions have been observed in a large cloud chamber operated at 3200 m altitude; the cloud chamber was controlled with Geiger counters and photomultipliers. The conclusions may be summarized by the following. The total cross section σ_c of the pions in C was measured by comparison with Pb to be 247 ± 60 mb. This result agrees with those of other experiments with light nuclei. The general indication is that the cross section for pions of these energies is somewhat lower than the geometrical. Those secondary nuclear interactions in which electromagnetic component is emitted were examined. The conclusion is that the average number of neutral π mesons emitted for secondary nuclear interaction is 0.31 ± 0.1. The cross section σ_{ch} for charge exchange is in the limits $0.16\,\sigma_{total} \leq \sigma_{ch} \leq (0.31 + 0.1)\sigma_{total}$. In an attempt to interpret these results, the values of $\sigma_{ch}/\sigma_{total}$ were estimated, using the results of Anderson, Fermi, Nagle, and Yodh with pions of 100 to 200 Mev against H. The resulting value $\sigma_{ch}/\sigma_{total} \cong 1/3$ is not in disagreement with the result of the present experiment. (auth)

6192

SOME COMMENTS ON THE THEORY OF V-PARTICLE. Ken-ichi Ono. Progr. Theoret. Phys. (Japan) 10, 111(1953) July.

The author proposed previously (Progr. Theoret. Phys. (Japan) 9, 524(1953)) that the V^0 particle has an unknown degeneracy, i.e., a large number of accessible internal states. This leads indirectly to the assumption that V particles are composite particles. Reasons are advanced to show why the V^0 particle cannot be considered as a composite particle. Therefore, the anomalous degeneracy of the V^0 particle must be considered, and some discussion of this is presented. (L.M.T.)

MOLECULAR PROPERTIES

6193

THE VISCOSITY OF ISOTOPIC SUBSTANCES. J. A. Pople. Physica 19, 668(1953) July.

In a recent communication (NSA 7-3551) it was suggested that the ratio of the viscosities of isotopic gases or liquids should be the square root of the ratio of the molecular weights. This note points out that this only follows from dimensional analysis under certain restricted conditions. (auth)

6194

SUBLATTICE EFFECTS IN MAGNETIC RESONANCE. Roald K. Wangsness. Phys. Rev. 91, 1085-91(1953) Sept. 1.

The resonance frequencies of a system containing two or four magnetic sublattices with different gyromagnetic ratios are calculated. It is found that in many cases the results reduce to the standard formulas of ferromagnetic and antiferromagnetic resonance; they are stated, however, in terms of an effective gyromagnetic ratio equal to the quotient of the net magnetic moment and the net angular momentum of the system. Line splitting due to the existence of several normal modes of nearly equal frequencies, and the effect of the sublattice structure upon the anisotropy contribution to the line width are also discussed. The calculated values of effective g values and line widths as a function of composition are compared with the experimental results for the nickel ferrite-aluminates. (auth)

NEUTRONS

6195

THE INFLUENCE OF A CADMIUM SHEET ON THE DISTRIBUTION OF NEUTRONS IN GRAPHITE. Nils Göran Sjöstrand. Arkiv Fysik 6, 497-512(1953) Aug. 10. (In English)

The "Cd difference method" is sometimes used in neutron physics to eliminate the effect of fast neutrons. Measurements are made both without and with a Cd sheet between the neutron source and the detector. The difference between the two sets of measurements then corresponds to those neutrons which are absorbed by the Cd, i.e., to those having energies less than about 0.3 ev. This method has recently been used at this laboratory for a determination of the diffusion length of thermal neutrons in graphite, and it became of interest to study in some detail the influence of a flat Cd plate on the neutron distribution in a rectangular graphite block. In the present paper a theoretical treatment of the problem is given, and experiments which were made to check the theoretical results are described. Good agreement was found between experiment and theory. (auth)

NUCLEAR PHYSICS

6196

Rutgers Univ.

NUCLEAR SPIN RELAXATION BY TRANSLATION DIFFUSION. H. C. Torrey. [nd] 26p. (AECU-2648)

The general theory of Bloembergen, Purcell, and Pound on nuclear spin relaxation has been extended to a more quantitative study of relaxation by translational diffusion. It has been found necessary to treat the problem by the theory of random walk. In the case of isotropic diffusion two cases have been studied: one in which the flight distance has a probability distribution and the other in which it is constant. The problem of random walk to nearest neighbor sites in a lattice is also treated, and quantitative results are obtained for a f.c.c. lattice. (auth)

6197

Knolls Atomic Power Lab.

TRANSFORMATION OF SCATTERING CROSS SECTIONS AND APPLICATIONS TO THE BOLTZMANN EQUATION. H. Hurwitz, Jr. and P. F. Zweifel. [1953] 9p. (AECU-2696)

In neutron-transport problems it is frequently desirable to expand the laboratory-system scattering cross section in Legendre polynomials of the cosine of the scattering angle. For theoretical analysis of the cross section, on the other hand, it is usually more convenient to make the corresponding expansion in the center-of-mass system. A method is presented for obtaining the transformation matrix between the coefficients of the Legendre polynomials in the laboratory and center-of-mass systems, and applications are made to the Boltzmann equation. (auth)

6198

Nuclear Physics Labs., Columbia Univ.

PROGRESS REPORT FOR APRIL, MAY, JUNE 1952 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. 36p. (CU-116)

Results obtained by counting γ rays obtained by the (n,γ) reaction in Ag show that relative values of σ_c/σ_T agree well with those calculated from transmission data. Measurements of fractional capture and of the σ_s/σ_T ratio in the 5.13-ev resonance of Ag are reported. A coherent scattering cross section of 4.0 ± 0.4 b was found for Te^{128} after the Te^{128} had been plated on V as a mirror. Paramagnetic neutron scattering cross sections were determined for Fe^{3+} in FeF_3 and $ZnFe_2SO_4$, and Mn^{++} in MnF_2 and MnO. A procedure for preparing rare-earth samples for the neutron-velocity spectrometer is briefly described. Kurie plots are shown for the β spectra of Cs^{135} and Tc^{99}. Search for low-energy γ rays (~80 kev) and internal conversion electrons in Bi^{210} yielded negative results. (For preceding period see CU-110.) (L.M.T.)

6199

Radiation Lab., Univ. of Calif., Berkeley

THE PRODUCTION OF 320 MEV DEUTERONS BY He^3 STRIPPING. John Ise, Jr., and Robert V. Pyle, Radiation Lab., Univ. of Calif., Berkeley and Donald A. Hicks and Robert M. Main, California Research and Development Co. Sept. 9, 1953. 15p. (UCRL-2319(rev.))

Deuterons can be accelerated in the 184-in. cyclotron to 190 Mev. To produce higher energy deuterons, doubly charged He^3 ions are accelerated to 510 Mev, and a fraction of them are stripped in an internal target, yielding deuterons with an average energy of 340 Mev. A current of 5×10^{-13} amp is obtained in the experimental "cave" external to the cyclotron shielding. Range measurements indicate that these deuterons have an average energy of about 320 Mev. The high cost of He^3 necessitates an efficient gas recovery system. The exhaust from the cyclotron diffusion pumps is passed through activated charcoal traps which are cooled to liquid N temperatures, and the gas which is not absorbed (presumably He) is returned to the cyclotron source. The loss from all causes is 0.8 cc/hr. (auth)

6200

POSITION OF THE FIRST EXCITED STATE IN NUCLEI WITH EVEN PROTON AND EVEN NEUTRON NUMBERS. P. Stähelin and P. Preiswerk. Nuovo cimento (9) 10, 1219-60(1953). Sept. 1. (In German)

The introduction refers to previous short communica-

tions on the first excited state of even-even nuclei. A survey shows that the lowest excitation energy of even-even nuclei is a smooth function of the neutron and proton number. In sequences of neighboring nuclei the excitation energy increases if the number of protons or of neutrons approaches the next magic number. Several nuclei which seemed to disobey this rule were reinvestigated experimentally, and in every case the new data obtained confirm the rule. The 145-kev radiation which accompanies the transmutation of Cl^{34} into S^{34} is an isomeric (M3) transition between the known 33-min state and the ground state of Cl^{34}, the half life of which is 1.45 sec. An $O^+ \rightarrow O^+$ transition with an ft value of 2,700 s leads directly to the ground state of S^{34}. Two different isotopes of antimony, Sb^{120} and Sb^{118}, have indistinguishable half lives of (16 ± 2) min. The 1.3-Mev level which previously was attributed to Sn^{120} belongs to Sn^{116}. The 60-min activity, with a γ ray of 0.70 Mev, probably has to be reassigned to mass number 115 (instead of 116). In Hg^{196} a reported γ ray of 175 kev could not be confirmed, and a new line corresponding to a first level at 426 kev was found. Further experiments deal with Mo^{96}, Zr^{92}, and Mo^{92}. The dependence of the lowest excitation energy on the number of protons and neutrons is interpreted in terms of the shell model. It is shown that a strong configurational interaction must be assumed, and that in general the first excited state is due to a simultaneous excitation of the neutron and the proton structure. (auth)

6201
CONTRIBUTION OF TENSOR FORCES TO QUADRUPOLE MOMENTS OF HEAVY NUCLEI. R. Gatto. Nuovo cimento (9) 10, 1311-24(1953) Sept. 1. (In Italian)

The contribution of tensor forces to quadrupole moments of heavy nuclei is evaluated. A particular assumption is made concerning the interaction, and it is found that, as long as saturation conditions are satisfied, the introduction of tensor forces does not give excessive quadrupole moments to heavy nuclei. (auth)

6202
SPIN-ORBIT COUPLING IN RIEMANN SPACES. V. Jules Géhéniau and Claudine Liesse. Compt. rend. 237, 303-4 (1953) July 27. (In French)

In Riemann spaces with spherical symmetry, the equation for quantizing the energy of a spin-½ particle has a term for spin-orbit coupling, even in nonrelativistic approximation. In this may be found the origin of the strong spin-orbit coupling of particles in the nucleus. (tr-auth)

6203
BIRMINGHAM NUCLEAR PHYSICS CONFERENCE. John K. Beling. Nucleonics 11, No. 10, 32-5(1953) Oct.

International progress in theoretical and experimental nuclear physics was reported in detail at a five-day conference. Summarized here are data on nuclear structure, reactions, and radii; high-energy scattering; heavy ions; light nuclei; theory of nuclear forces; and techniques. (auth)

6204
THE QUESTION OF INTERACTION CROSS SECTIONS OF EXTRA-FAST NUCLEONS. E. L. Feĭnberg and D. S. Chernavskiĭ. Doklady Akad. Nauk S.S.S.R. 91, 511-13 (1953) July 21. (In Russian)

The quantum structure of a meson field of nucleons was calculated by the method of large parameters of impact. It was shown that the interaction cross section does not increase with energy as Heisenberg claimed but remains always equal geometrically. The character of each impact will be that of a nucleon interacting with one meson. (J.S.R.)

6205
PRODUCTION OF MESONS AND THE LOCALIZATION OF FIELD ENERGY. H. J. Bhabha. Proc. Roy. Soc. (London) A219, 293-303(1953) Sept. 22.

It is shown that the production of mesons and nucleons in very energetic nucleon-nucleon collisions depends essentially on the extent to which the observed rest mass of a nucleon is due to its meson field and the spatial distribution of the energy in this field. The production of showers of mesons and nucleons is considered, assuming that a fraction ϵ of the observed rest mass of the nucleon is carried by the field, this rest mass being distributed according to some arbitrary function f of distance from the center of the nucleon. The remaining fraction of the rest mass is assumed to be concentrated in a sphere of radius ζ round the center of the nucleon, this radius being of the order of the Compton wavelength of the nucleon or less. It is shown how the experimental study of meson-nucleon production in high-energy encounters provides a method of obtaining information on the contribution of the meson field to the rest mass of a nucleon and the localization of this energy in the meson field. (auth)

NUCLEAR PROPERTIES

6206
Microwave Lab., Stanford Univ.
HIGH ENERGY ELECTRON SCATTERING AND NUCLEAR STRUCTURE DETERMINATIONS. R. Hofstadter, H. R. Fechter, and J. A. McIntyre. Aug. 1953. 37p. (ML-205)

Electrons of energies 125 and 150 Mev are deflected from the Stanford linear accelerator and brought to a focused spot of dimensions 3mm × 15mm at a distance of 9 ft from a double-magnet deflecting system. The focus is placed at the center of a brass scattering chamber of diameter 20 in. Thin foils are inserted in the chamber, and elastically scattered electrons from these foils pass through thin Al windows into the vacuum chamber of a double-focusing analyzing magnet of the inhomogeneous field type. The energy resolution of the magnet has been about 1.0% in these experiments. This resolution is enough to clearly separate H or D elastic peaks from C peaks in the same scattering target. The energy loss in the foils is readily measurable. In the case of light nuclei, e.g., H, D, Be, C the shift of the peak of the elastic curve as a function of scattering angle indicates the recoil of the struck nucleus. Relative angular distributions are measured for Be, Ta, Au, and Pb. These data indicate that the charge distribution in heavy nuclei possesses a maximum in the center with a gradual taper to the outside. The best fit of first Born approximation form factors suggests an exponential charge distribution with root-mean-square radii 12 to 22% larger than conventional radii. The radii show considerable dependence on the function assumed for the charge-density taper. Among the gaussian, half-uniform-half guassian, uniform, uniform with exponential, etc., tapers which were tried, all were definitely poorer than the exponential in representing the experimental data. (auth)

6207
Naval Research Lab.
GAMMA RADIATION FROM INTERACTION OF 14-MEV NEUTRONS WITH VARIOUS ELEMENTS. V. E. Scherrer, R. B. Theus, and W. R. Faust. June 22, 1953. 27p. (NRL-4197)

Experiments have been performed to observe the γ radiation produced by interaction of 14-Mev neutrons with various materials. These included C, O, Al, Fe, Ni, Cu, Cd, and Pb. Generally the γ spectrum of all elements appears to consist of a low energy continuum overlaid by a series of discrete lines or bands at higher energies. The square root of the total γ-ray cross section is a linear function of $A^{1/3}$ from C to Cd. (auth)

6208
Rochester Univ.
CONVERGENCE OF THE ADIABATIC NUCLEAR POTENTIAL. [PART] 2. Abraham Klein. Aug. 10, 1953. 11p. (NYO-3832)

A conjecture made in a previous paper concerning the non-convergence of the series of adiabatic nuclear potentials for meson pair theory obtained by means of perturbation methods is shown to be incorrect. The correct series is derived and summed and is in agreement with a result given previously by Wentzel. The same methods suffice for the derivation and summation of two additional series of potentials of the pseudoscalar theory with pseudoscalar coupling. One of these has as its leading term the one-pair potential of fourth order, and the other begins with the leading term of sixth order. Each series has the same radius of convergence which is determined by the condition $xe^x > 2\alpha$, where x is the separation of the nucleons in units of the meson Compton wavelength and $\alpha = (g^2/4\pi)(\mu/2M)$. With $(g^2/4\pi) = 15$, perturbation theory converges for $x > 0.85$; with $(g^2/4\pi) = 10$, for $x > 0.57$. The convergence for $x \leq 1$ is in any case very slow for these values of the coupling constant. The possibility remains that for substantially smaller values of the coupling constant, as are suggested by the inclusion of radiative corrections, perturbation calculations of adiabatic potentials may yield a meaningful first approximation when used in conjunction with a suitable cut-off. (auth)

6209
Radiation Lab., Univ. of Calif., Berkeley
EVIDENCE FOR SUBSHELL AT Z = 96. Glenn T. Seaborg. Sept. 3, 1953. 8p. (UCRL-2335)

A plot of r_θ vs. atomic number in the region Z = 84 to 98 indicates a plateau at Z = 96 (Cm) which is interpreted as evidence for a subshell structure. An additional plateau is barely discernable at Z = 90. It is pointed out that the α decay of Bk^{243} and Bk^{245}, which is slower than theory predicts, might be explained by a closed proton shell at Z = 96, in a manner similar to that already observed for the odd-even isotope Z = 83. Additional arguments are considered based on the filling of $p_{1/2}$ states rather than $f_{5/2}$ and $f_{1/2}$ states in Ac^{227} and Pa^{231}. (K.S.)

6210
ANALYSIS OF EXCITED NUCLEAR LEVELS BY MEANS OF A SHELL MODEL. L. K. Peker, L. A. Sliv, and A. V. Zolotavin. Translated from Doklady Akad. Nauk S.S.S.R. 88, 781-4(1953). 3p. (NSF-tr-75; D-88-781)

An abstract of this report appears in Nuclear Science Abstracts as NSA 7-5154.

6211
THE GROUND STATE OF Cl^{34}. D. C. Peaslee. Nuovo cimento (9) 10, 1349-50(1953) Sept. 1. (In English)

Both theoretical arguments and experimental evidence indicate that the isotopic spin of the Cl^{34} ground state is T = 1. The nucleus Cl^{34} thus appears as a remarkable exception, being the only N = Z nucleus now known to have $T \neq 0$ in its ground state and violating the general rule that all light nuclei show $T = T_z = T_{min}$ in their ground states. Cl^{34} is just barely an exception because the 3^+ first-excited level fails to be the ground state only by ~0.15 Mev, a relatively small interval in light nuclei. It is shown that perturbation of Coulomb forces can not produce T = 1 in the ground state, nor can nuclear forces if good L-S coupling is assumed. The effect is explained by j-j coupling perturbed by l_1l_2 and s_1s_2 interactions of roughly equal magnitudes. The very light odd-odd N = Z nuclei do not show this behavior, probably because of greater dominance of L-S coupling. (G.Y.)

6212
SPIN OF CERTAIN ODD-ODD NUCLEI. III. CASE OF POTASSIUM-40. Claude Marty, Roger Nataf, and Jacques Prentki. Compt. rend. 237, 137-9(1953) July 15. (In French)

In parts I and II, those nuclei consisting of filled shells plus one exterior proton and one exterior neutron, such as RaE (Bi^{210}), were studied. An analogous investigation is carried out for those nuclei formed of shells lacking one proton (or one neutron) and having one exterior neutron (or proton), such as K^{40}. The same potentials used in part II are used here. (tr-auth)

6213
SCINTILLATION STUDY OF As^{77} AND Br^{77}. M. E. Bunker, R. J. Prestwood, and J. W. Starner. Phys. Rev. 91, 1021-2 (1953) Aug. 15.

The energies and intensities of 8 γ rays emitted in the decay of As^{77} are given. The half life of As^{77} was measured to be 38.68 ± 0.09 hr. The low-energy portion of the γ-ray spectrum of Br^{77} is shown. A tentative partial decay scheme for As^{77} and Br^{77} is presented. (L.T.W.)

6214
SPIN OF CERTAIN ODD-ODD NUCLEI. II. PRACTICAL CALCULATIONS AND RESULTS. Claude Marty, Roger Nataf, and Jacques Prentki. Compt. rend. 237, 31-3(1953) July 6. (In French)

Practical applications of the equations given in part I (NSA 7-4888) consist in choosing explicitly the potential $V(r_{12})$ of the interaction between the two exterior nucleons. The constants c_i of V may be estimated with the aid of data on the deuteron and the n-p scattering on one hand, and the conditions of saturation of nuclear forces on the other. The authors take $(c_1, c_2, c_3, c_4) = (1; 4; \frac{1}{2}; \frac{1}{2})$ and study spins of nuclear levels for several cases: RaE (Bi^{210}), Tm^{170}, and Y^{90}. (tr-auth)

6215
NUCLEAR QUADRUPOLE RESONANCE OF BORON. André Bassompierre. Compt. rend. 237, 39-41(1953) July 6. (In French)

Calculations by the Heitler-London equation of the electric field gradients within the BO_3 group indicate that orthoborates should be suitable crystals with which to study the quadrupole moments of the B isotopes by means of nuclear quadrupole resonance. About 1 Mc should be a suitable frequency. (G.Y.)

6216
PILE NEUTRON CAPTURE CROSS SECTIONS OF Co^{60*} (10.5 MIN.) AND Co^{60} (5.25 YR.). F. Brown, J. L. Wolfson, and L. Yaffe. Can. J. Phys. 31, 903-10(1953) Sept.

Activity of approximately 105-min half life has been detected in samples of Co^{59} irradiated at high-neutron fluxes in the NRX Reactor. By a study of the yield as a function of neutron flux and time of irradiation, this activity was demonstrated to be due to Co^{61} (105 min) formed by neutron capture in Co^{60}. The pile neutron capture cross sections were found to be 95 ± 45 b and 6.0 ± 1.4 b for the Co^{60*} (10.5 min) and Co^{60} (5.25 yr) isomers, respectively. (auth)

6217
TOTAL REACTION CROSS SECTIONS OF THE ELEMENTS N, Na, Al, AND Si FOR 1.9 TO 3.8 MEV NEUTRONS. R. Meier, R. Ricamo, P. Scherrer, and W. Zünti. Helv. Phys. Acta. 26, 451-64(1953) Sept. 15. (In German)

Total neutron cross sections of N, Na, Al, and Si have been measured by means of transmission experiments in the range 1.9 to 3.8 Mev. Monoenergetic neutrons were obtained from the D-D reaction in a thin heavy-ice target with a spread in energy between 20 and 50 kev. Many new excited levels of N^{15}, Na^{24}, Al^{28}, and Si^{29} were found. A level in N^{15}, excited with 2.25-Mev neutrons, has been analyzed and is proposed to be a $J = \frac{1}{2}$, odd parity state. (auth)

6218
A THEORETICAL INVESTIGATION OF THE NUCLEAR RESONANCE ABSORPTION SPECTRUM OF Al^{27} IN SPODUMENE. G. Lamarche and G. M. Volkoff. Can. J. Phys. 31, 1010-14(1953) Sept.

A theoretical investigation is presented of the energy levels of a nucleus of spin I = 5/2, a given magnetic moment μ, and electric quadruple moment eQ, placed in a uniform magnetic field H_0, and a crystalline electrostatic potential ϕ without axial symmetry. The dependence of the energy levels, line frequencies, and transition matrix elements on the dimensionless parameter $R \equiv 4\mu H_0/eQ\phi_{zz}$ is calculated for Al^{27} for one orientation of a spodumene crystal in the magnetic field H_0 over the interesting range of the parameter R linking up the pure quadrupole with the Zeeman spectrum. Other orientations of the crystal are discussed briefly. (auth)

NUCLEAR REACTORS

6219
Clinton Labs.
THE TWO GROUP THEORY OF PILES WITH MULTIPLE REFLECTORS. H. L. Garabedian and A. S. Householder. Nov. 11, 1946. Decl. Aug. 28, 1953. 17p. (AECD-3585; MonP-202)

A procedure is established for limiting the order of the fundamental determinant for calculating pile critical size to four. It is shown that the method outlined is applicable to cases involving an arbitrary number of reflectors. (K.S.)

6220
Phillips Petroleum Co.
THE MATERIALS TESTING REACTOR AS AN IRRADIATION FACILITY. John R. Huffman. July 6, 1953. Decl. with Deletions Aug. 19, 1953. 24p. (AECD-3587; IDO-16113)

A discussion is presented of the functions of the MTR as an irradiation facility. A general description of the reactor is followed by a detailed review of the experimental and service facilities. Several cross-sectional plans of the reactor and neutron flux profiles are included. (K.S.)

6221
FISSION-PRODUCT POTENTIAL OF COMMERCIAL REACTORS AND THEIR PROCESSES. Dick Duffey. Nucleonics 11, No. 10, 9-13(1953) Oct.

Suggested uses of fission-product radiation and potential demands are briefly outlined. The principal reactor sources of such radiation discussed include: (1) separated fission products from used fuel; (2) external fuel streams from fluid reactors; (3) discharged solid fuel; and (4) the reactor core itself. Data are presented on the radiation dosage for suggested applications and the estimated fission-product source requirements. Four possible types of future reactor complexes are considered in relation to the problem of supplying the fission products. (L.M.T.)

6222
THEORY OF HOMOGENEOUS NUCLEAR REACTORS. II. EFFECT OF NEUTRON SPECTRUM ON DYNAMIC CONDITIONS IN A REACTOR. Alejandro Medina. Rev. mex. fis. 2, 79-116(1953) Apr. (In Spanish)

The effect of the fission-neutron spectrum on the dynamic conditions of a pile is examined. The diffusional approximation leads to integrodifferential equations that can be solved by taking Laplace transforms. A general inhour equation results which describes the conditions of thermal and intermediate piles when the Fredholm determinant of the original equations does not vanish. The fast pile appears as a special case when the determinant vanishes, corresponding to the absence of an equilibrium thermal-neutron density in the pile. (auth)

NUCLEAR TRANSFORMATION

6223
Brookhaven National Lab.
CAPTURE GAMMA-RAYS FROM THE PROTON BOMBARDMENT OF Be^9. W. F. Hornyak and T. Coor. 26p. [nd] (BNL-1533)

The γ rays produced at the 0.993- and 1.085-Mev proton capture resonances in Be^9 were studied using a NaI scintillation spectrometer. Gamma rays of energies 0.41, 0.72, 1.02, 1.43, and 7.5 Mev and energies 0.72, 1.43, 2.0 to 2.5, and 6.89 Mev were observed for the two levels, respectively. Absolute yields were determined, and the possible decay schemes are discussed. (auth)

6224
Los Alamos Scientific Lab.
SURVEY OF SEVERAL OF THE REACTIONS OCCURRING WHEN LITHIUM AND BERYLLIUM ARE BOMBARDED BY PROTONS AND DEUTERONS OF 30–250 KEV. J. A. Phillips and G. A. Sawyer. Aug. 1953. 14p. (LA-1578)

Approximate cross sections based on 90° yields have been measured for the following reactions in the energy interval 30 to 250 kev:

1. $Li^6(p,\alpha)He^3$
2. $Li^7(p,\alpha)He^4$
3. $Li^7(p,\gamma)Be^8$
4. $Li^6(d,\alpha)He^4$
5. $Li^6(d,p)Li^7$
6. $Li^7(d,n)He^4 + He^4$
7. $Be^9(d,\alpha)Li^7$
8. $Be^9(d,p)Be^{10}$ – Long-range protons
9. $Be^9(d,p)Be^{10*}$ – Short-range protons
10. $Be^9(p,\gamma)B^{10}$

If an isotropic distribution of the reaction products is assumed, no unreported resonances were found. Gamow plots with the theoretical slopes pass through the measured points within experimental error. (auth)

6225
ANGULAR DISTRIBUTIONS OF PROTONS FROM $Na^{23}(d,p)Na^{24}$. S. Takemoto, T. Dazai, and R. Chiba. Phys. Rev. 91, 1024-5(1953) Aug. 15.

The angular distributions of the protons from the $Na^{23}(d,p)Na^{24}$ reaction have been observed. The intensity ratio at 90° of the ground-state group to the sum of the groups corresponding to the two excited states at 0.672 and 0.564 Mev is ~ 1 : 2.2. (L.T.W.)

6226
DECAY OF K^{42}. Bernd Kahn and W. S. Lyon. Phys. Rev. 91, 1212-3(1953) Sept. 1.

The γ spectrum of 12.44-hr K^{42} has been examined using a NaI(Tl) γ-ray spectrometer. One γ ray of energy 1.5 Mev has been found; the fraction of the decay proceeding through this transition is 0.200 ± 0.010. (auth)

6227
THEORY OF REARRANGEMENT COLLISIONS. Yoichi Fujimoto, Satio Hayakawa, and Kazuhiko Nishijima. Progr. Theoret. Phys. (Japan) 10, 113-14(1953) July.

The theory of the rearrangement collisions such as d-p reactions is constructed along the line of the general theory of scattering developed by Lippmann and Schwinger (Phys. Rev. 79, 469(1950)) and others. (auth)

6228
TERNARY FISSION WITH THE THIRD FRAGMENT HAVING SHORT RANGE. Hubert de Laboulaye, Christophe Tzara, and Janine Olkowsky. Compt. rend. 237, 155-7(1953) July 15. (In French)

Although ternary fission in which the third particle has a long range is well recognized, conflicting reports have appeared on the existence of ternary fission with the emission of a particle of mass 4 to 13 and less than 1 cm range in air. An investigation with an internally controlled cloud chamber, using natural U, revealed that the short-range particles are probably knock-on atoms and that the phenom-

enon, if it exists at all, has a frequency of only 1 ± 3 per 1000 fissions, which is at most one-tenth of the frequency indicated in the literature. (G.Y.)

6229

MULTILEVEL SCATTERING IN FOCK SPACE. I. F. M. Medina Nicolau. Rev. mex. fis. 2, 117-35(1953) Apr. (In Spanish)

In the present paper, the first of a series, the time-dependent description of the many-level scattering is discussed. The interaction is assumed to take place through the formation of a compound nucleus, and the description is given in an appropriate Fock space. In particular, the Hamiltonian of the problem is derived, and the quantum mechanical representation of the potential is given, this potential having no classical analog. (auth)

6230

THE REACTIONS $He^3(He^3,p)Li^5$ AND $T(He^3,p)He^5$. E. Almqvist, K. W. Allen, J. T. Dewan, T. P. Pepper. Phys. Rev. 91, 1022-3(1953) Aug. 15.

Range and energy distributions of charged particles resulting from the reactions $He^3(He^3,p)Li^5$ and $T(He^3,p)He^5$ are shown. The Q valves for these reactors are 10.86 ± 0.15 Mev and 11.18 ± 0.07 Mev, respectively. By use of the mass scale of Li et al. (Phys. Rev. 83, 512(1951)), these Q valves lead to masses of 5.01414 ± 0.00016 and 5.01382 ± 0.00007 for Li^5 and He^5. (L.T.W.)

6231

GAMMA-RAY SPECTRUM OF AS^{77}. F. Rasetti and E. C. Booth. Phys. Rev. 91, 1192-3(1953) Sept. 1.

The γ-ray spectrum following the β decay of As^{77} was investigated by means of a scintillation spectrometer. The following γ-ray energies (in kev) and intensities (quanta per disintegration) were observed: 88(0.003); 155(~0.002); 243(0.023); 528(0.007). Coincidence experiments show that the 88- and 155-kev lines are emitted in cascade, while the other two lines do not coincide with any other. A level diagram for the product nucleus Se^{77} is suggested. (auth)

6232

DETECTION OF POLARIZATION OF (d,d) NEUTRONS BY SCATTERING ON CARBON. E. Baumgartner and P. Huber. Helv. Phys. Acta. 26, 545-62(1953) Sept. 15. (In German)

The degree and direction of polarization of neutrons from the (d,d) reaction has been determined. The measurements were made with deuteron energies ranging from 250 to 900 kev. The neutrons, emitted by a thick D_2O target, were observed at an angle of 45° (laboratory system) with reference to the direction of the deuteron beam. The scattering of neutrons by carbon was used as an analyzer. The change of degree of polarization is plotted as function of the deuteron energy. The results are compatible with theoretical estimations of the polarization effect, based on the Konopinski-Teller model of the (d,d) reaction, including tensor forces only. The degree of polarization observed at 600 kev deuteron energy amounts to 18 ± 7%. The direction of polarization is perpendicular to the plane of reaction and forms a right-handed cartesian system with the velocity of deuterons and neutrons. (auth)

6233

RADIATIONS FROM ZR^{89}. F. J. Shore, W. L. Bendel, H. N. Brown, and R. A. Becker. Phys. Rev. 91, 1203-11(1953) Sept. 1.

A betatron-induced (γ,n) reaction on Zr^{90} has been found to produce a third branch in the decay of the 4.4-min state of Zr^{89}. The new branch includes a 1.53-Mev γ ray (8% as intense as the 588-kev γ ray) coincident with positrons of approximately 850-kev maximum energy. These particles (log ft = 4.2 ± 0.1) are in competition with the 2.4-Mev positron group (log ft = 6.9 ± 0.3) emitted in the decay, to the ground state of Y^{89}, of the 4.4-min Zr^{89m}. Anomalous behavior of the comparative half lives is indicated, since both the 2.4-Mev and the 901-kev, 79-hr positron transitions are thought to be allowed. K/(L+M) conversion ratios for the 4.4-min, 588-kev and the 79-hr, 913-kev γ radiations are, respectively, 5.4 ± 0.7 and 7 ± 2. A ten-channel scintillation spectrometer, based on a cathode-ray tube, light pipes, and photomultiplier tubes, to effect pulse-height selection, is also described. (auth)

6234

ACCURATE DETERMINATIONS OF NUCLEAR REACTION ENERGIES. K. F. Famularo and G. C. Phillips. Phys. Rev. 91, 1195-1202(1953) Sept. 1.

A precise magnetic spectrometer of the annular type is described; the focusing properties and line shapes are analyzed. The use of the instrument to measure absolute particle momenta in terms of the proton magnetic moment precessional frequency and a standard length is presented for three nuclear transmutations and for the determination of the energy necessary to excite a state in Ne^{20}. The Q values obtained are: $C^{12}(d,p)C^{13}$, Q = 2.722 ± 0.004 Mev; $O^{16}(d,\alpha)N^{14}$, Q = 3.119 ± 0.005 Mev; and $Li^7(p,\alpha)He^4$, Q = 17.344 ± 0.013 Mev. The energy at a resonance in the reaction $F^{19}(p,\alpha\gamma)O^{16}$ was determined to be 872.5 ± 1.8 kev. (auth)

6235

RADIATIONS FROM ARSENIC 77 AND GERMANIUM 71. B. L. Saraf, J. Varma, and C. E. Mandeville. Phys. Rev. 91, 1216-8(1953) Sept. 1.

The radionuclide As^{77} has been shown by scintillation spectrometry to emit γ rays of energies 32, 87, 160, 247, 270, and 520 kev. It is estimated that these quanta are associated with β-ray branches totaling about 2.5% of the total β radiation. The continuous γ-ray spectrum accompanying orbital electron capture in Ge^{71} has been shown to have an end point at 225 ± 12 kev. Log ft is calculated to be 4.4(ΔI = 0, 1; no), consistent with an assignment of spin $\frac{1}{2}$ to the ground state of Ge^{71} in accord with the theory of the shell model. Some data relative to γ rays from Os^{193} and Ge^{77} are included. (auth)

6236

RADIATIONS OF Ra^{227}. J. P. Butler and J. S. Adam. Phys. Rev. 91, 1219-21(1953) Sept. 1.

Ra^{227} has been prepared by the slow-neutron irradiation of Ra^{226} in the NRX Reactor. Ra^{227} is a β^- emitter with a half life of 41.2 ± 0.2 min and with a β^- end point of 1.31 ± 0.02 Mev. Gamma rays of 291 and 498 kev were observed with a scintillation spectrometer. The cross section for the reaction $Ra^{226}(n,\gamma)Ra^{227}$ was found to be 23 b. (auth)

6237

THE NEUTRON CAPTURE γ-RAYS FROM POTASSIUM. G. A. Bartholomew and B. B. Kinsey. Can. J. Phys. 31, 927-31(1953) Sept.

The capture γ rays from K have been re-examined with greater resolution than was used in previous experiments. The upper end of the spectrum has been carefully studied both with a sample of natural K_2CO_3 and with another in which the K was enriched in K^{40}. From a comparison of the spectra two γ rays with energies of 9.39 ± 0.06 and 8.45 ± 0.02 Mev are assigned to capture by that isotope. The strong γ ray at 7.757 ± 0.008 Mev, previously ascribed to the ground-state transition in K^{40}, is now found to represent a transition to a low-lying excited state in that nucleus. (auth)

6238

BREMSSTRAHLUNG FROM P^{32} BETAS. M. Goodrich, J. S. Levinger, and W. Payne. Phys. Rev. 91, 1225-8 (1953) Sept. 1.

A NaI scintillation spectrometer has been used to study

the spectral distribution of bremsstrahlung from P^{32} betas stopped in brass. Experimental measurements are compared with calculations based on the theoretical photon distribution, corrected for the response of the crystal. The experimental and calculated curves agree within 10% for photon energies from 50 to 1100 kev. (auth)

6239
THEORY OF PHOTONUCLEAR REACTIONS. Claude Mercier and André Herpin. Compt. rend. 237, 556-8 (1953) Sept. 14. (In French)

Introduction of a complex potential into the formation of the compound nucleus permits the explanation of both the form and order of magnitude of the total cross section for photonuclear reactions, as well as the variation with the atomic number, without introducing arbitrary parameters. (tr-auth)

PARTICLE ACCELERATORS

6240
EFFECT OF ARBITRARY ROTATIONS OF MAGNETS ON THE RESONANCE BANDS OF THE STRONG-CONVERGENCE COSMOTRON. Joseph Seiden. Compt. rend. 237, 560-2(1953) Sept. 14. (In French)

Sturrock has remarked recently that small rotations α_i (twists) of the magnets of the strong-focusing cosmotron about their ideal position result in coupling the radial and vertical betatronic oscillations. The effect of such twists on the phase of the particles is analyzed, and it is shown that the effect is of the second order in α_i and that the resulting widening of the resonance bands is minimum. (G.Y.)

6241
VAN DE GRAAFF ACCELERATORS FOR STERILIZATION USE. F. L. Foster, D. R. Dewey II, and A. J. Gale. Nucleonics 11, No. 10, 14-17(1953) Oct.

The capabilities of 3 types of Van de Graaff accelerators for radiation sterilization are discussed in relation to sterilization needs and approximate cost factors. The capabilities are based on the efficiency of beam utilization, which in turn is limited by the intensity distribution of the beam, both depth-wise and lateral, in the product. (L.M.T.)

6242
EXPERIMENTS ON RADIATION BY FAST ELECTRON BEAMS. H. Motz, W. Thon, and R. N. Whitehurst. J. Appl. Phys. 24, 826-33(1953) July.

The results of some experiments on millimeter wave and light generation by means of an undulator are described. After a brief survey of the theoretical background the design of a magnet system is discussed. An experiment is described in which a 100-Mev electron beam from the Stanford linear accelerator passed through the undulator. Light radiated by the beam was observed and the plane of polarization determined. A small linear accelerator with good bunching action was used for an experiment on millimeter wave generation. At a beam energy of 3 Mev, radiation in a wavelength band below 1.9 mm was observed. A peak power output of the order of one watt was obtained. Millimeter waves generated in the accelerator tube were also observed. (auth)

6243
EFFECT OF ANOMALOUS ATTENUATION IN A LINEAR ACCELERATOR. C. W. Miller and G. Saxon. Nature 172, 463(1953) Sept. 5.

The energy expected from a certain traveling-wave linear accelerator (NSA 7-2412) for various loading conditions has been calculated from the series impedance and data on the position of electron bunching. Although agreement with measured performance at light loading is good, serious discrepancy occurs at higher loading. The discrepancy is attributed to an anomalous attenuation that has been found to occur in the accelerator over a certain range of power flux. The mechanism causing the increase in attenuation is not fully understood, and it is therefore impossible to make an accurate allowance for the effect. If, however, it is assumed that the criterion which determines the value of the anomalous attenuation is the mean of the input and output power fluxes, the calculated performance figures may then be modified. (G.Y.)

6244
OVERCOMING THE CRITICAL ENERGY IN THE STRONG-FOCUSING SYNCHROTRON. E. Bodenstedt. Z. Naturforsch. a8, 502-3(1953) Aug. (In German)

The strong-focusing synchrotron has the disadvantage with respect to the classical synchrotron that at a certain critical energy the stable equilibrium position of the phase oscillations becomes unstable and the focusing region becomes defocusing. It is not possible for large proton accelerators to remain below this energy during the whole acceleration process. A type of phase stabilization to overcome this disadvantage is proposed. (G.Y.)

RADIATION ABSORPTION AND SCATTERING

6245
Brookhaven National Lab.
THE PROPAGATION OF GAMMA RAYS IN AIR; PROGRESS REPORT, JANUARY 1–JUNE 30, 1953. W. Bernstein and M. M. Weiss. 19p. (BNL-1540; AFSWP-448)

Initial rough measurements of the quality of the γ radiation from Co^{60} in air indicated agreement with the theoretical calculations of Spencer and Fano for an infinite water medium. Further experiments were performed, duplicating the conditions assumed in the calculations. Since the spectral region between 100 kev and 1 Mev has already been examined, it was decided to investigate in detail the region below 100 kev and above 1.0 Mev. Total radiation dosage measurements were made in water using Victoreen ion chambers. The build-up factor was measured as a function of distance. Good agreement was obtained with the results of White. The spectrum below 150 kev was examined with a small NaI(Tl) scintillation counter and both the shape of the spectrum and the attenuation as a function of distance were in good agreement with the calculations. At distances less than 30 cm from the source the spectral shape changed, gradually broadening with the peak shifting to higher energies. The primary region above 1.0 Mev was examined using a large NaI(Tl) crystal, and the gradual loss of resolution in the two primaries as a function of distance with an increase in lower energy events was shown. (auth)

6246
Brookhaven National Lab.
INELASTIC SCATTERING OF THERMAL NEUTRONS IN LEAD. Andrew W. McReynolds. [1953] 10p. (BNL-1568)

The total thermal inelastic scattering cross section of Pb has been measured from transmission of a single crystal from 2 to 8 A (0.02 to 0.0013 ev) at 80 and 295°K and is found to be in quantitative agreement with current theory of one-phonon process of energy exchange with the lattice. Measurements of differential cross section at 1.08 A (0.07 ev) are in agreement with Debye-Waller theory. Thus, inelastic cross section through the thermal range is found to fit the two theories in their ranges of validity. (auth)

6247
Radiation Lab., Univ. of Calif., Berkeley
NOTE ON THE SCATTERING OF MANY PARTICLE SYSTEMS. S. Tamor. Aug. 21, 1953. 5p. (UCRL-2313)

The S matrix for an over-all scattering process is explicitly constructed in terms of the S matrices for elementary interactions. The properties of an impulse approximation, combined with the Racah formalism, thereby permit the reduction of many-body scattering to a two-body process. (K.S.)

6248

SCATTERING OF X-RAYS BY METALS AT VERY SMALL ANGLES. B. M. Rovinskii [Rovinsky] and V. M. Genkin. Translated from Doklady Akad. Nauk S.S.S.R. 89, 673-5 (1953). 3p. (NSF-tr-84; D-89-673)

An abstract of this report appears in Nuclear Science Abstracts as NSA 7-5440.

6249

MEASUREMENTS OF GAMMA-RAY DOSAGE IN FINITE ABSORBERS. Ernest J. Henley. Nucleonics 11, No. 10, 41-3(1953) Oct.

The photon beam attenuation, dosage distribution, and energy absorption must be determined by dosimetry in the design of a radiation-processing installation. Measurements of a cylindrical Co^{60} source and concentric absorbers with polyvinyl chloride dosimeters are shown to agree well with calculated values based on Beer's Law. (L.M.T.)

6250

INTERACTION BETWEEN α PARTICLES AND PROTONS IN THE INTERIOR OF THE $Bi^{212}H_3$ MOLECULE. Dragolioub K. Yovanovitch and Drachko D. Yovanovitch. Compt. rend. 237, 43-5(1953) July 6. (In French)

$Bi^{212}H_3$ was condensed on a polished brass plate which was then covered with E1 nuclear emulsion. Examination of the developed emulsion showed an anomalously high number of proton tracks emerging from agglomerations of $Bi^{212}H_3$. It is difficult to explain this phenomenon either classically or quantum mechanically as caused by collision between the α particles emitted by the 60.5-min decay of Bi^{212} and the H nuclei, but it may be analogous to the internal photoelectric effect, in which the probability of interaction is very great at atomic distances. (G.Y.)

6251

ON THE SCATTERING OF FAST ELECTRONS. I. ELASTIC SCATTERING. H. Mitter and P. Urban. Acta Phys. Austriaca 7, 311-23(1953) Oct. (In German)

The scattering of Dirac electrons by a Yukawa potential is investigated with the aid of the Feynman-Dyson equation. First, the validity of the development is evaluated, then the effective cross section up to the third Born approximation is discussed. The evolved integrals are calculated for the second approximation, and for the third approximation the special case of a coulomb potential is closely considered. Correction terms that do not diverge are calculated. The equations are equally valid for positrons if the sign of Z is reversed. In further work the scattering corrections and losses by bremastrahlung will be treated in the second Born approximation. (tr-auth)

6152

SCATTERING PROBLEM IN THE INTERMEDIATE-COUPLING THEORY, I. Ziro Maki, Masatomo Sato, and Sinitiro Tomonaga. Progr. Theoret. Phys. (Japan) 9, 607-32 (1953) June.

The intermediate-coupling theory is generalized so as to include dynamical problems such as meson-nucleon collisions. The underlying physical picture, as well as the results obtained, resembles in many respects the dispersion theoretical treatment of nuclear processes. Relations of the method with other approximation methods are investigated. (auth)

6253

NEUTRON DIFFRACTION BY LIQUID HELIUM. D. G. Henshaw and D. G. Hurst. Phys. Rev. 91, 1222(1953) Sept. 1.

Preliminary results of a measurement of the angular distribution of 1.08A neutrons scattered by liquid He at 4.2°K over the angular range 3.8 to 31° are reported. A maximum in the scattering occurs at $21.3 \pm 1°$, corresponding to a peak at 3.6A in the radial distribution of density about any atom in the liquid. (auth)

6254

EXCHANGE SCATTERING OF AN ELECTRON BY THE HYDROGEN ATOM. Saul Altshuler. Phys. Rev. 91, 1167-71(1953) Sept. 1.

The theory of scattering of electrons by H has been re-examined with the objective of identifying the matrix element for the exchange-scattered amplitude from the same integral equation which provides direct-scattered amplitudes. The theory of Mott and Massey is verified, but it is demonstrated that their result contains contributions from the incident wave which must be removed before computing exchange amplitudes. The result is a theoretical justification for the Oppenheimer (prior) matrix element. (auth)

6255

COMPLEX AMPLITUDES FOR ELECTRON SCATTERING BY ATOMS. Jean A. Hoerni and James A. Ibers. Phys. Rev. 91, 1182-85(1953) Sept. 1.

The partial waves scattering theory has been applied to electron scattering by U and F atoms at 40 and 11 kev. The electron scattering by the UF_6 molecule, predicted from these results, is in good agreement with experiment. (auth)

6256

THE EXCITATION OF MOLECULAR ROTATIONS AND VIBRATIONS IN INELASTIC SCATTERING PROCESSES. Edward H. Kerner. Phys. Rev. 91, 1174-81(1953) Sept. 1.

A discussion is first given of the collisions of composite systems in general, where it is shown how the scattering amplitude may be written as a superposition of little amplitudes for the scattering of each particle in one system by each particle in the other. This is followed by the calculation of scattering cross sections for single charges by N molecules with excitation of rotational and vibrational states of motion; the collision of molecules with molecules, including the case that they are identical, is also discussed and applied to N_2-N_2 scattering. The smallness of internal rotational and vibrational velocities is exploited in the use of the Born approximation. Detailed numerical results are given. (auth)

6257

POLARIZABILITY OF THE DEUTERON. N. F. Ramsey, B. J. Malenka, and U. E. Kruse. Phys. Rev. 91, 1162-4 (1953) Sept. 1.

The theory of the polarizability of the deuteron in a uniform electric field is developed. Using the properties of the deuteron Green's function, an expression for polarizability of the deuteron which exhibits its dependence upon the spin orientation of the deuteron is obtained. This dependence arises from the inclusion of a tensor force in the neutron-proton interaction. In terms of the magnetic quantum number m, with respect to the direction of the electric field, the polarizability α is $\alpha_{SS} + (3m^2 - 2)\alpha_{SD} + (3m^2 - 2)^2\alpha_{DD}$. When Hulthén wave functions are used for the deuteron, α_{SS} is found to be approximately 0.56×10^{-39} cm^3 and α_{SD} 0.027×10^{-39} cm^3. The applicability of the theory to intramolecular interaction measurements and deuteron scattering experiments is discussed. (auth)

6258

THE ELECTRIC SCATTERING OF THE POLARIZABLE DEUTERON. B. J. Malenka, U. E. Kruse, and N. F. Ramsey. Phys. Rev. 91, 1165-7(1953) Sept. 1.

The effect of the electric polarizability of the deuteron upon its electric scattering is discussed for cases in which $Ze^2/hv \gg 1$, and the classical closest distance of approach is so large that the effects of direct nuclear interaction are negligible. Under such circumstances, the chief departure from the Rutherford scattering law is due to the polarizability of the deuteron. The magnitude of the departure is calculated, and in particular, the polarizability contribution to backward scattering is estimated to be respectively about 3 and 4% for 8-Mev and 10-Mev deuterons scattered by Bi and U. (auth)

6259
DEFLECTION OF HIGH-ENERGY ELECTRONS IN MAGNETIZED IRON. Stephan Berko and Frank L. Hereford. Phys. Rev. 91, 1127-30(1953) Sept. 1.

High-energy electrons are scattered in magnetized Fe. From a shift in the multiple scattering curves due to the reversal of the magnetic field, the effective field b_{eff} acting on electrons traversing ferromagnetic media is computed. Such an effective field is dependent on the short range forces between beam electrons and spin-aligned ferromagnetic electrons. The measurements show an effective field equal to the macroscopically measured flux density B. (auth)

6260
IONIZATION OF GAS BY ELECTRONS. Julian K. Knipp, Tetsuo Eguchi, Masao Ohta, and Shozo Nagata. Progr. Theoret. Phys. (Japan) 10, 24-30(1953) July.

A statistical analysis is made for the number of ions produced by an electron when it is absorbed in H_2 gas. The average number and the mean-square fluctuation of the ion pairs as functions of the incident energy of the electron satisfy inhomogeneous linear integral equations which yield Fano's results in the first approximation. (auth)

6261
DEUTERON STRIPPING REACTION. Shiro Yoshida. Progr. Theoret. Phys. (Japan) 10, 1-10(1953) July.

By use of the same assumption as Butler (Proc. Roy. Soc. A208, 36(1951)), deuteron stripping cross sections are obtained in terms of the nuclear widths in the single-level formula. By means of this expression the reduced widths are computed from the experimental data. (auth)

6262
SLOW-NEUTRON SCATTERING CROSS-SECTIONS OF MAGNESIUM. P. A. Egelstaff and R. Jackson. Nature 172, 415(1953) Aug. 29.

The total cross section of Mg has been measured for neutrons of from 0.5 to 1000 ev energy. The spectrum is illustrated. Since the absorption cross section of Mg is negligible in this neutron energy range, the measurement is actually that of the free-atom scattering cross section. The calculated bound-atom scattering cross section is 3.82 ± 0.10 barns. By subtraction of the mean of several coherent scattering cross sections given in the literature, the value 0.27 ± 0.14 barn is obtained for the incoherent cross section. (G.Y.)

RADIATION EFFECTS

6263
Illinois Univ.
COLOR CENTERS AND TRAPPED CHARGE IN ALKALI HALIDE CRYSTALS (thesis). David Bellamy Dutton. July 1952. 71p. (NP-4797; U-23200; Technical Report 5)

Crystals of KCl and KBr were irradiated with x rays at low temperatures and optical-absorption measurements were made as a function of wavelength. An electric field (500 to 1000 v/cm d-c) was then applied, and the current in the crystal, as a function of time and temperature, was measured as the crystal was warmed gradually to room temperature. The intensity of luminescence resulting from the thermal release of electrons from F centers was also measured. Results are presented graphically for both crystals along with a discussion of the results. (L.M.T.)

6264
THE EFFECT OF NEUTRON BOMBARDMENT UPON THE MAGNETIC SUSCEPTIBILITY OF SEVERAL PURE OXIDES. J. D. McClelland and J. J. Donoghue. J. Appl. Phys. 24, 963(1953) July.

The magnetic susceptibility of samples of SiO_2, Al_2O_3, and MgO was found to decrease upon exposure at 30°C in the Hanford reactor at integrated neutron fluxes of 0.51×10^{19} and 3.76×10^{19} nvt. The specific susceptibilities, measured by the Faraday method at fields of 8,000 to 16,000 gauss, are presented for 6 different specimens. (L.M.T.)

6265
SIZE EFFECTS IN THE INITIATION AND GROWTH OF EXPLOSION. F. P. Bowden, K. Singh, and A. M. Yuill. Nature 172, 378-80(1953) Aug. 29.

The effect of hot-spot size in initiating explosions has been studied by irradiating explosive crystals of Cd, Pb, Ag, and Li azides and Ag acetylide with slow neutrons (10^8 neutrons/cm^2/sec). In no case did explosion occur, although interesting changes were observed in the crystals. In a second series of experiments, the crystals of Pb azide and Cd azide were mixed with U oxide and irradiated with neutrons. Again no explosion occurred. In these last experiments, the energy of the fission products is ~94 Mev and the range of these particles in Pb axide is $\sim 10^{-3}$ cm. It is clear that irradiation of this kind could produce the decomposition of a large number of adjacent azide molecules, but it does not cause explosion, even when the crystals were maintained at 290°C during irradiation. Irradiation with α partjcles and γ radiation also failed to cause explosion. Electron-beam irradiation caused explosion of Pb azide, but this was attributed to a bulk heating. Neutron irradiation does produce interesting changes in the crystal. Color changes and darkening, indicating the formation of F centers and nuclei, are observed. This affects the subsequent course of the thermal decomposition of the explosive. (G.Y.)

RADIOACTIVITY

6266
Brookhaven National Lab.
A NEW EXCITED STATE OF AN EVEN-EVEN NUCLEUS: Kr^{80} (abstract). Gertrude Scharff-Goldhaber and Michael McKeown. [1953] 1p. (BNL-1517)

The 18-min isomer Br^{80} is shown to emit γ rays of 620-kev energy which follow a low-intensity ($9 \pm 2\%$) β-ray branch. β-γ coincidences are observed, indicating that the γ transition takes place in Kr^{80}. No γ transitions were found to follow the positron or K-capture branch. The intensity observed is compatible with a spin and parity assignment 1+ for the ground state of Br^{80}, while the 620-kev state in Kr^{80} is probably 2+. The energy observed fits well into the pattern for the energy of the first excited state of even-even nuclei. (P. Preiswerk and P. Stähelin, Helv. Phys. Acta 24, 623(1952); G. Scharff-Goldhaber, Phys. Rev. 90, 587(1953)). (Entire report. Abstract of paper for Albuquerque meeting of Am. Physical Society, Sept. 2-5, 1953.)

6267
Oak Ridge National Lab.
STUDIES ON THE NUCLEAR CHEMISTRY OF TIN. C. M. Nelson, B. H. Ketelle, and George E. Boyd. Issued Nov. 10, 1950. 51p. (ORNL-828)

The irradiation of enriched isotopic preparations of all the stable isotopes of Sn by intense slow neutron sources has lead to definite mass assignments for all of the previ-

ously known periods in Sn between the masses 112 and 125, as well as to the discovery and assignment of several new activities. The Sn radioactivities produced by either (n,γ) or (n,n) reactions were examined using absorption techniques, and, where possible, they were accurately characterized by magnetic lens, proportional, and scintillation spectrometer measurements. (auth)

6268

Oak Ridge National Lab.

ANGULAR CORRELATION IN ALLOWED β-TRANSITIONS. M. E. Rose. Issued Sept. 24, 1953. 27p. (ORNL-1591)

A brief abstract of this report appears in Nuclear Science Abstracts as NSA 7-4978.

6269

Geological Survey

TABLES FOR THE CALCULATION OF RADIOACTIVE EQUILIBRIUM FROM BATEMAN'S EQUATION. F. J. Flanagan and F. E. Senftle. July 1953. 18p. (TEI-333)

Tables of decay constants and functions thereof are presented to simplify the problem of calculating the constants involved in the Bateman equation. An alternate method of solving for the amounts of the nth member of a radioactive series is given in the form of a power series. (auth)

6270

Radiation Lab., Univ. of Calif., Berkeley

COMPLEX ALPHA SPECTRA OF RADIOTHORIUM (Th^{228}) AND THORIUM-X (Ra^{224}). Frank Asaro, Frank Stephens, Jr., and I. Perlman. June 12, 1953. 24p. (UCRL-2244)

The α and γ spectra of Th^{228} have been studied with an α-particle spectrograph and γ-ray scintillation counters. Th^{228} has α groups of 5.421 (71%), 5.3385 (28%), 5.208 (0.4%), and 5.173 Mev (0.2%), and γ rays of 89 (1.6%), 137 (0.26%), 169 (0.09%), and 212 kev (0.27%). Spins and parities are assigned to the energy levels defined by the α groups and the results are evaluated with respect to the developing theory and systematics of complex α spectra. (auth)

6271

HALF-VALUE PERIODS FOR THE DECAY OF ALUMINIUM-26, ALUMINIUM-25 AND NITROGEN-13. J. L. W. Churchill, W. M. Jones, and S. E. Hunt. Nature 172, 460(1953) Sept. 5.

The decays of the positron emitters Al^{26}, Al^{25}, and N^{13} produced by proton bombardment of Mg^{25}, Mg^{24}, and C^{12}, respectively, were measured with a G-M counter and a nine-channel scaler. The following half lives were found: Al^{26}, 6.68 ± 0.11 sec; Al^{25}, 7.62 ± 0.13 sec; and N^{13}, 602.9 ± 1.9 sec. (G.Y.)

6272

UPPER LIMIT OF THE HALF LIFE OF THE 1.33-MEV EXCITED STATE OF Ni^{60}. S. Gorodetzky, A. Knipper, R. Armbruster, and A. Gallmann. J. phys. radium 14, 550-1 (1953) Oct. (In French)

The method of delayed coincidences has been used to find an upper limit of 0.7×10^{-9} sec for the half life of the 1.33-Mev excited state of Ni^{60} during the decay of Co^{60}. (G.Y.)

6273

AUTORADIOGRAPHY OF ATMOSPHERIC AEROSOLS. E. Moraschinelli. Nuovo cimento (9) 10, 1341-2(1953) Sept. 1. (In Italian)

The hypothesis is sometimes presented that the successive elements of the U-Ra and Th series found in aerosols in the atmosphere are in respective radioactive equilibria. In order to test this supposition, a thin layer of atmospheric solid particles was deposited electrostatically on Ilford E1 emulsion, and the resulting α tracks in the emulsion were identified by length measurements. The presence of ThC′ (Po^{212}), RaC′ (Po^{214}), RaA (Po^{218}), and ThC (Bi^{212}) α particles was observed, but evidence for the equilibrium of the RaA → RaB → RaC → RaC′ → RaD series is considered doubtful. The process of attachment of the radioactive species to the aerosol may be too time-dependent to permit equilibrium to be established. (G.Y.)

6274

PREPARATION OF UZ (Pa^{234}) AND STUDY OF ITS β RADIATION. Georges Bouissières, Nadine Marty, and Jean Teillac. Compt. rend. 237, 324-6(1953) July 27. (In French)

A 0.75-mc carrier-free solution of Ux1 (Th^{234}), from which UZ (Pa^{234}) could be milked periodically, was prepared by thenoyltrifluoroacetone extraction of an aqueous extraction of $UO_2(NO_3)_2$. Details of the preparation are given. Study of the UZ radiations with an intermediate-image-type magnetic-lens spectrometer revealed conversion lines at 83, 105, 114, 140, 160, 215, 256, 479, 586, 642, 737, and 836. Assignment of these lines and shape of the β spectrum are discussed. (G.Y.)

6275

INVESTIGATION OF Zn^{65} WITH A PROPORTIONAL COUNTER. Paul Avignon. Compt. rend. 237, 157-9(1953) July 15. (In French)

The Zn^{65} source was placed on polyvinyl film of ~1 mg/cm² thickness and inserted on a probe into a proportional counter. A coaxial 2000-gauss magnetic field retained the electrons within the counting space. The β^+ spectrum was determined; a maximum of 311 ± 10 kev was found. The value 32.5 was obtained for the ratio of total K capture to β^+ emission. (G.Y.)

6276

NATURAL RADIOACTIVITY OF TUNGSTEN. W. Porschen and W. Riezler. Z. Naturforsch. a8, 502(1953) Aug. (In German)

A weak α activity was observed in nuclear emulsion saturated for 2 to 4 months with aqueous $Na_2W_2 \cdot 2H_2O$ or K_2W_4. The energy of 3.2 Mev suggests a half life, according to the Gamow-Teller equation, of $\sim 6 \times 10^9$ yr, which in turn indicates an abundance of only $\sim 2.5 \times 10^{-9}$. The authors suggest the existence of a very rare, heretofore unknown W isotope, possibly W^{178}, which has almost disappeared since the formation of the elements. (G.Y.)

6277

ANGULAR CORRELATION OF THE Ni^{60} γ-γ CASCADE. Robert M. Kloepper. Phys. Rev. 91, 1026(1953) Aug. 15.

Experimental angular correlation data for Ni^{60} are compared with the calculated data on the assumption of a 4(E2)2(E2)0 cascade. (L.T.W.)

6278

DETERMINATION OF THE LIFETIME OF THE 27-KEV ELECTRIC DIPOLE RADIATION EMITTED IN THE $Pa^{231} \xrightarrow{\alpha} Ac^{227}$ TRANSITION. Jean Teillac, Michel Riou, and Paul Desneiges. Compt. rend. 237, 41-3(1953) July 6. (In French)

Delayed-coincidence measurements show that the 27-kev γ radiation of Pa^{231} is emitted with a half life of 4.2×10^{-8} sec and is that of an electric dipole. (tr-auth)

6279

UPPER LIMIT OF THE HALF LIFE OF O^{16} IN THE 6.13-MEV EXCITED STATE. Serge Gorodetzky, Raymond Armbruster, André Gallmann, Albert Knipper, and Théo Muller. Compt. rend. 237, 45-7(1953) July 6. (In French)

A delayed α-γ coincidence measurement of the $F^{19}(p,\alpha)O^{16}$ reaction showed that the 6.13-Mev second excited state of O^{16} decays with a half life of $9.0 \pm 1 \times 10^{-10}$ sec, in agreement with an approximation given by the Weisskopf equation. (G.Y.)

6280

THE COMPTETITION BETWEEN $d_{5/2}$ AND $g_{7/2}$ LEVELS IN Sb, I, Cs, AND La; THE DECAY OF ^{135}La. A. H. Wapstra. Physica 19, 671-2(1953) July.

The positions of the $d_{3/2}$ and $g_{7/2}$ levels in I^{125}, I^{127}, Cs^{131}, I^{129}, I^{131}, and La^{137} are determined from a knowledge of their groundstates and the known difference between the two levels in Sb^{123}, Sb^{125}, Cs^{133}, Cs^{135}, and La^{139}. The γ spectra of La^{135} was remeasured to better determine its groundstate. The spectrum shows a γ ray at 485 ± 15 kev and an indication of a γ ray of intensity $\frac{1}{4}$ as great at 660 kev. A $d_{3/2}$ groundstate is suggested for La^{135} on the basis of the results. (L.M.T.)

6281

THE BRANCHING RATIO OF POTASSIUM 40. R. D. Russell, H. A. Shillibeer, R. M. Farquhar, and A. K. Mousuf. Phys. Rev. 91, 1223-4(1953) Sept. 1.

The branching ratio of K^{40} has been measured by determining the A and K content of K feldspars of accurately known ages. The results obtained for five samples differing in age by more than a factor of five are all consistent within the limits of error with a branching ratio of 0.060 ± 0.006 when a total decay constant of 0.54×10^{-9}/year is assumed. The authors feel that the results obtained indicate that loss of A from these samples during geological time is unlikely. (auth)

6282

HALF LIVES OF Fe^{59} AND Zn^{65}. Jacques Tobailem. J. phys. radium 14, 553(1953) Oct. (In French)

High-precision determinations with an arrangement of two differential ionization chambers and with specially purified samples gave the following half lives: Fe^{59}, 45.0 ± 0.2 days; Zn^{65}, 245.0 ± 0.8 days. (G.Y.)

6283

THE β-γ ANGULAR CORRELATION OF Sb^{124}. Masato Morita and Masami Yamada. Progr. Theoret. Phys. (Japan) 10, 111-13(1953) July.

Langer et al. (Phys. Rev. 91, 338(1953)) explained the highest-energy β group of Sb^{124} by the first forbidden ST-type interaction of Fermi theory with reduced nuclear matrix elements and spin change one. The authors of this note (Progr. Theoret. Phys. (Japan) 8, 449(1952)) explained both the β-γ angular correlation and the β spectrum of $Sb^{124} \rightarrow Te^{124*} \rightarrow Te^{124}$ by assuming the pure tensor interaction with the nuclear matrix elements and the electric quadrupole transition in the same spin change as Langer's case. Therefore, the β-γ angular correlation is investigated here with the ST-type interaction, and results are presented. (L.M.T.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

6284

THE MAGNETIC PROPERTIES OF CERTAIN RARE-EARTH ETHYL SULPHATES. R. J. Elliott and K. W. H. Stevens. Proc. Roy. Soc. (London) A219, 387-404(1953) Sept. 22.

The theory of the magnetic properties of rare-earth ions in crystals which has been developed in preceding papers (Proc. Phys. Soc. A65, 209(1952); Proc. Roy. Soc. A215, 437(1952); A218, 553(1953)) is here applied to the ethyl sulfates. The magnetic resonance and susceptibility results are discussed at length, and it is shown that the observations can be explained by using fields of C_{3h} symmetry which vary in a systematic way as one rare-earth ion is replaced by another. (auth)

SPECTROSCOPY

6285

Engineering Research Inst., Univ. of Mich.
INFRARED STUDIES OF CRYSTALS. QUARTERLY REPORT [FOR] PERIOD AUGUST 15, 1952 TO NOVEMBER 15, 1952. G. B. B. M. Sutherland, R. T. Mara, and W. G. Simeral. Nov. 1952. 10p. (NP-4814; AD-4193; Quarterly Report 5)

Results are reported from polarization studies on a muscovite sample and from infrared spectral studies on two muscovite samples and one phlogopete sample. No definite changes were found in the infrared spectra of four diamonds which had been exposed 30 hr in the ORNL Graphite Reactor. (L.M.T.)

6286

Arkansas Univ. Engineering Experiment Station
DEVELOPMENT OF AN INSTRUMENT FOR THE INSTANTANEOUS ANALYSIS OF GAS MIXTURES. QUARTERLY PROGRESS REPORT, JULY 1, 1952 TO SEPTEMBER 30, 1952. Oct. 21, 1952. 12p. (NP-4837; AD-455; Quarterly Progress Report 3)

Construction of a nonmagnetic mass spectrometer has been achieved. Separation is accomplished by ion acceleration and focusing by a combination of applied a-c and d-c fields. Design criteria exclude the use of slits and require compact packaging of pump and vacuum equipment. (K.S.)

6287

ABSORPTION OF LIGHT AND DIELECTRIC CONSTANT OF ALKALI HALIDE CRYSTALS. A. A. Vorobyov. Translated from Doklady Akad. Nauk S.S.S.R. 90, 157-8 (1953). 2p. (NSF-tr-67; D-90-157)

The relationship between light absorption and dielectric constants in alkali halide crystals is investigated. For Na and K, this relation is close to the linear dependence required by an equation due to Mott, $\Delta E \sim e^{-2}$. As a general rule, in alkali halide salts, electronic binding energies decrease with an increase in dielectric constant. (K.S.)

6288

VOLUME EFFECT IN THE ISOTOPE SHIFT IN HYDROGEN AND DEUTERIUM. D. D. Ivanenko and N. N. Kolesnikov. Translated from Doklady Akad. Nauk S.S.S.R. 91, 47-50(1953). 5p. (NSF-tr-79; D-91-47)

The volume effect caused a displacement of the electron term. The volume effect has been calculated on the assumption that the potential of the nuclear interaction possesses the character of a square well. For H, the volume effect is 0.11 mcps; for D, 0.78 mcps. The total H-D shift is 0.44 mcps. (J.S.R.)

6289

AN INTERPRETATION OF VIBRATION SPECTRA AND COMPUTATION OF THE POTENTIAL ENERGY PARAMETERS OF DEUTEROETHYLENES. L. M. Sverdlov and N. L. Pakhomova. Translated from Doklady Akad. Nauk S.S.S.R. 91, 51-4(1953). 4p. (NSF-tr-80; D-91-51)

The deformation vibrations of the B_{1g} and B_{1u} types of symmetry in the C_2H_4 and C_2D_4 spectra were re-evaluated. On the basis of this interpretation the force constants were calculated by the method of variation of parameters. The agreement of the calculated frequencies of deuterated ethylenes with the observed frequencies is good. (J.S.R.)

6290

BROADENING OF MICROWAVE ABSORPTION LINES DUE TO WALL COLLISIONS. Michael Danos and Stanley Geschwind. Phys. Rev. 91, 1159-62(1953) Sept. 1.

The broadening of microwave absorption lines due to wall collisions is calculated using a method introduced by Johnson and Strandberg. Two types of absorption cell are studied, i.e., infinite plane parallel plates and a circular cylinder, each in a region of uniform microwave field. The usual assumption that the half-power half-width is given by $\Delta\nu = 1/2\pi\tau$, where τ is the mean time between collisions, is in good agreement with the detailed calculations of the present work which show that the error in the line width as calculated by the above expression is not larger than 30%. Experimentally observed line widths agree with the predicted values. (auth)

6291
SHIFT OF THE 1^1S STATE OF HELIUM. S. Chandrasekhar and Donna Elbert. Phys. Rev. 91, 1172-3(1953) Sept. 1.

The shift of the 1^1S state of He is reconsidered, and it is shown that recent discussions of the problem are subject to considerable doubt. The doubt arises from the unreliability (to the required precision) of the current theoretical determinations of the energy of the ground state. The result of an improved calculation for the latter is presented; and if this is accepted as a sufficient approximation, an unexplained shift of 21.5 cm^{-1} (opposite in direction to that previously suggested) would result for He. Similar unexplained shifts (but in the same direction as those suggested earlier) are also predicted for the other He-like ions. (auth)

6292
ELECTRONIC STRUCTURE OF F CENTERS: HYPERFINE INTERACTIONS IN ELECTRON SPIN RESONANCE. A. F. Kip, C. Kittel, R. A. Levy, and A. M. Portis. Phys. Rev. 91, 1066-71(1953) Sept. 1.

It is shown that the observed width of the microwave electron-spin resonance-absorption lines associated with F centers in KCl, NaCl, and KBr crystals can be attributed to hyperfine interactions between the F-center electron and the nuclear magnetic moments of the ions adjacent to the F center. The width arises from the distribution of nuclear moment components. Theoretical calculations of the width are in good agreement with observation provided that the F-center wave function is treated as a linear combination of atomic orbitals; wave functions calculated on continuum models are shown to be unsatisfactory. The theory is confirmed by a comparison of observations on F centers in crystals of $K^{39}Cl$ and $K^{41}Cl$. If the width is attributed to interactions with the nearest sets of K and Cl ions, the experiments lead directly to quantitative values of the electronic charge density at the K and Cl nuclei: $|\Psi(K)|^2 = 0.70 \times 10^{24}$ cm^{-3} and $|\Psi(Cl)|^2 = 0.12 \times 10^{24}$ cm^{-3}. (auth)

6293
ELECTRONIC STRUCTURE OF F CENTERS: SATURATION OF THE ELECTRON SPIN RESONANCE. A. M. Portis. Phys. Rev. 91, 1071-8(1953) Sept. 1.

It is shown that the unusual observed saturation behavior of the microwave electron-spin resonance associated with F centers in KCl, NaCl, and KBr crystals can be accounted for if the over-all width is ascribed to interaction between the F-center electrons and the nuclear magnetic moments of the ions adjacent to the F centers. The measured saturation factor gives for F centers in KCl a spin-lattice relaxation time of 2.5×10^{-5} sec at room temperature. The observed saturation behavior in which only the absorption saturates is in marked disagreement with the Kramers-Kronig relations. However it is shown, that the Kramers-Kronig relations are not applicable to saturated systems. Expressions which avoid the use of these relations are presented for saturable systems. (auth)

6294
CROSS TERMS IN ALLOWED SHAPE β SPECTRA. J. P. Davidson and D. C. Peaslee. Phys. Rev. 91, 1232-3(1953) Sept. 1.

A statistical analysis is made of allowed-shape β spectra to determine the magnitude of any 1/W terms that may be present. Both allowed and first-forbidden spectra are analyzed; only the allowed spectra are discussed here. It is concluded that the (T,A) mixture in β decay is ~4%. Unfortunately, only one measurement can be used for the (S,V) mixture, and it does not limit the mixture to less than ~10%. For neither (T,A) nor (S,V) is the mixture significantly different from zero. (auth)

THEORETICAL PHYSICS

6295
Radiation Lab., Univ. of Calif., Berkeley
A NOTE ON THE GREEN'S FUNCTION METHOD. Maurice Neuman. July 16, 1953. 12p. (UCRL-2280)

The Green's function method is adapted to the description of strongly interacting particles which become more loosely bound as their number increases. (auth)

6296
THREE-PARTICLE COULOMB PROBLEMS. Christian Frönsdal and Aadne Ore. Physica 19, 605-10(1953) July.

It is found that information concerning dynamical stability and inter-particle separation of singly charged 3-particle Coulomb systems in general is an automatic result of a rational choice of units of length and of energy. This is true to the extent to which the ground states of the numerous systems of this kind are describable in terms of wave functions of the inter-particle distances of attractive pairs of particles only. (auth)

6297
ON THE SEPARABILITY OF DIRAC EQUATION. Takehiko Takabayasi. Progr. Theoret. Phys. (Japan) 9, 681-3(1953) June.

In previous papers (Progr. Theoret. Phys. (Japan) 8, 143(1952); 9, 187(1953)) the author investigated the formulation of quantum mechanics which describes a quantum-mechanical motion of a system by an ensemble of its corresponding classical motions modified by certain force. Certain restrictions were imposed on the applicability of this formulation, and a Dirac particle is treated here with these restrictions considered. (L.M.T.)

6298
ON THE POTENTIAL OF THREE BODIES. Maurice Jean and Jean Ratier. Compt. rend. 237, 305-7(1953) July 27. (In French)

Some results on three-nucleon potentials obtained within the framework of the symmetric-charge theory of the pseudoscalar meson, with coupling in γ_5, are presented. The static approximation obtained by using an adiabatic method is the same as that given by the Tamm-Dancoff method. Fourth- and sixth-order expressions are derived which correspond to the existence of one and three virtual nucleon pairs. The expressions may be of interest in comparing the relative contributions of doublet and triplet forces and in serving as a guide to a semiphenomenological study of the problem of the triton, for example. (G.Y.)

6299
ON THE FAMILIES OF SPINOR FIELDS. Sadao Ôneda and Hiroomi Umezawa. Progr. Theoret. Phys. (Japan) 9, 685-7(1953) June.

The spinor fields are classified into several families from the formal requirement of quantized field theory (Nishijima, Progr. Theoret. Phys. 5, 187(1950)) and the recently accumulated, rather temporary knowledge on elementary particles. (auth)

6300
COMPLEMENTARITY IN ANGULAR-MOMENTUM STATES. B. A. Lippmann. Phys. Rev. 91, 1213-5(1953) Sept. 1.

By introducing operator representations for angular-momentum states referred to arbitrary axes of quantization, two independent angular momenta, each referred to its own axis of quantization, may be combined quantum mechanically. An interpretation in terms of complementarity shows that this method of adding angular momenta corresponds to a "causal" description, while the usual method (using only one axis of quantization) is a "geometric" or space-time description. "Causal" angular-momentum states automatically avoid the sums over magnetic quantum numbers in cascade processes. (auth)

6301
ON THE D STATE PROBABILITY OF DEUTERON. Sigeru Machida. Progr. Theoret. Phys. (Japan) 9, 683-4(1953) June.

From the experimental values of the magnetic moments of the proton, neutron, and deuteron, it can only be said of P_D, the D-state probability of the deuteron, that $0\% < P_D < 10\%$. In this note it is shown that by utilizing the experimental ratio of the hfs separations of the ground states of D and H, a more reliable value, $5\% < P_D \lesssim 10\%$, can be obtained. (L.M.T.)

6302
NORMALIZATION OF THE CONSTANTS IN THE THEORY OF QUANTA. E. C. G. Stueckelberg and A. Petermann. Helv. Phys. Acta. 26, 499-520(1953) Sept. 15. (In French)

A mathematical foundation to the method previously employed (NSA 5-4047) to give a definite meaning to the products of invariant distributions in terms of arbitrary constants $c_1, c_2 \ldots c_i \ldots c_{r(n)}$ is proposed. The nth approximation $\underline{S}^{(n)}$ of the $\underline{S}[V]$ matrix (defined for a given space-time region V) depends on these r(n) arbitrary constants in addition to the arbitrary physical parameters (masses κ, μ, and coupling constants e, g,...). A definite physical meaning can be given to the masses κ, μ. A coupling parameter, however, can only be specified in terms of a chosen development of a function S(xy.., κ.., c_i..) of physical significance. However, the terms of the actual correspondence development (in terms of e^2) $S = S_2 + S_4 + \ldots$ have no physical meaning. Therefore the coefficient e^2 in S_2 has only a mathematical significance. It requires that the functions of xy... S_4, S_6, ... S_n have all been specified. As this specification involves the c_i's, we must expect that a group of infinitesimal operations $\underline{P}_i = (\partial/\partial c_i)_{c=0}$ exists, satisfying $\underline{P}_i S = h_{ie}(\kappa, \mu, e)\, \partial S(\kappa\mu e, 00\ldots)/\partial e$, admitting thus a renormalization of e. The only way of attack being the correspondence principle, the invariance properties of a classical theory, linear in the Dirac field, are discussed. In addition to the Weyl group of gauge invariance, a group exists whose consequence is the equivalence theorem between pseudoscalar and pseudovector coupling with the pseudoscalar meson field. It is shown that the definition of distributions in terms of the c_i's is a generalization of the method of L. Schwartz. This permits discussion of the group of normalization given by the $\underline{P}_i$'s. Certain restrictions are imposed on this group, if we require invariance of $\underline{S}$ with respect to the corresponding classical groups (Weyl and equivalence). The limiting case of photons with zero rest mass then can be defined. (auth)

6303
FOURTH-ORDER RADIATIVE CORRECTIONS TO ATOMIC ENERGY LEVELS. J. Weneser, R. Bersohn, and N. M. Kroll. Phys. Rev. 91, 1257-62(1953) Sept. 1.

In this paper the fourth-order radiative corrections to the elastic scattering of an electron in the field of a fixed potential are examined, using the Dyson S-matrix formulation of quantum electrodynamics. The result can be represented as an addition to the interaction-energy density of the electron with the external potential: $-ie\bar{\psi}(x)\gamma_\mu\psi(x)\Box^2/\kappa^2 A_\mu^e(x)[(\alpha^2/4\pi^2)(0.52 \pm 0.21)]$, plus the anomalous magnetic moment already known. The contributions that arise from the vacuum-polarization currents are omitted. This term calculated contributes to the level shift in a hydrogenic atom an energy of $(\alpha^4 Z^4/n^3)\, Ry\delta_{l,0}[(4/\pi^2)(0.52 \pm 0.21)]$. For the 2S level of H this is 0.24 ± 0.10 Mc/sec. (auth)

6304
NEW THEORY OF PARTICLES OF ARBITRARY SPIN AND ITS APPLICATION TO CALCULATION OF CROSS SECTIONS FOR COULOMB SCATTERING. Gérard Petiau. J. phys. radium 14, 501-9(1953) Oct. (In French)

Some fundamental properties are proposed concerning the formalism of a general theory of particles having spins of a multiple of $\hbar/2$, in which a system of irreducible wave equations represents a particle possessing the total spin $n\hbar/2$ and the single value of the proper mass m_0, completely avoiding objections raised against analogous theories previously proposed. In the second part, general expressions are established for the cross section for electromagnetic Coulomb scattering resulting from the collision of two distinct elementary particles of spins $n\hbar/2$ and $m\hbar/2$. (tr-auth)

6305
THEORY OF THE INTERACTIONS WITH HIGHER DERIVATIVES AND ITS APPLICATION TO THE NON-LOCAL INTERACTION. Yasuhisa Katayama. Progr. Theoret. Phys. (Japan) 10, 31-56(1953) July.

By extending Yang-Feldman's method to the system with the interaction Lagrangian with higher derivatives, the hamiltonian in the interaction representation is obtained. It is shown that the hamiltonian thus obtained is given by the usual Heisenberg-Pauli method using the canonical conjugates associated with the independent variables of the variation; i.e., if such canonical variables be taken, the system is reduced to the familiar case without higher time derivatives. This theory, when applied to the nonlocal interaction straightforwardly, can be used to explain the differences between the nonlocal interaction and the nonlocalized action. The possibilities of removal of the divergences by introducing the nonlocalities is discussed. (auth)

6306
NEW DESCRIPTION OF FIELD. Yoshirô Takano and Itaru Suzuki. Progr. Theoret. Phys. (Japan) 10, 110-11(1953) July.

One of the authors (Takana et al., Progr. Theoret. Phys. (Japan) 9, 86(1953)) in describing the field by the differential form treated the meson fields as the linearized equations and gave clear correspondences to the usual formalism. This note discusses the proof of the Lorentz invariance of the field equations described by the differential form, the derivation of the quadratic equation, and the relation to the Lagrangian formalism. The appendix contains the explanation of the differential form. (auth)

6307
ON THE CONSERVATION OF HEAVY PARTICLES. Osamu Hara, Toshio Marumori, Yoshio Ohnuki, and Hajime Shimodaira. Progr. Theoret. Phys. (Japan) 10, 114-15(1953) July.

This note is the direct continuation of a previous one on the theory of the structure of elementary particles by Hara and Marumori (Prog. Theoret. Phys. (Japan), in press), and extends the previous theory to spinor fields. Results indicate that the conservation of heavy particles seems to be strong evidence for the existence of a new intrinsic structure in spinor particles. (L.M.T.)

6308
SCATTERING PROBLEMS WITH SPIN-ORBIT COUPLINGS. T. Regge and M. Verde. Nuovo cimento (9) 10, 997-1011 (1953) Aug. 1. (In English)

With the aim of treating the scattering of neutrons by deuterons in presence of tensor forces or spin-orbit couplings a variational principle is given which does not use Green's tensor. The method is an extension of that due to Hulthén for the case of two bodies and central forces. The two-body case with tensor potentials, the three-body case with central forces, and finally the more general case of neutron-deuteron scattering with spin-orbit coupling are discussed. (auth)

6309
HAS THE ISOTOPIC SPIN ANY SENSE FOR LIGHT PARTICLES? M. Cini and A. Gamba. Nuovo cimento (9) 10, 1040-6(1953) Aug. 1. (In English)

The possibility of extending the concept of isotopic spin to muons, electrons, and neutrinos produced in the pion decay, muon decay, β-decay and nuclear capture of the muon is investigated. If these reactions are charge independent it follows that the isotopic spin $\frac{1}{2}$ must be assigned to all fermions. Furthermore the β-decay neutrino must be different from the pion decay neutrino, which has to be properly denoted as neutretto. Some reactions by means of which the hypothesis of charge independence could be tested are proposed, but they are all far beyond the present experimental possibilities. (auth)

6310
DIAGONALIZATION OF THE HAMILTONIAN IN THE THEORY OF FIELDS. II. B. Ferretti. Nuovo cimento (9) 10, 1079-125(1953) Aug. 1. (In Italian)

A renormalization method for quantum electrodynamics which in no step makes use of the perturbation theory is developed. In this method the electric charge is a parameter which may vary with continuity. It is then shown how it is possible to construct explicitly the Feynman representation of any observable for a value of the charge which differs by an infinitesimal amount from a given value, when this representation is supposed known for the given value of the charge. It is shown further how the divergencies which arise by varying the charge can be formally eliminated by means of the renormalization. (auth)

6311
NONLOCAL THEORY OF THE INTERACTION BETWEEN FERMI PARTICLES. P. Budini and C. Villi. Nuovo cimento (9) 10, 1172-86(1953) Aug. 1. (In Italian)

A nonlocal, relativistically invariant treatment of the renormalizable interaction between Fermi particles is given. Following the Kristensen and Möller's schema a theory is outlined starting from the Lagrangian interaction. The S-matrix is derived to the first and second approximations. The formalism is applied to the study of the first order process $\mu^- + P \rightarrow N + \nu$. In this case it is sufficient to take a two-point form factor. With the proper choice of the Fourier transform of the form factor (which although not of the "normal class" in this case gives the same results as the normal one) the formalism becomes the same as if the process had been considered to be $\mu^- + P \rightarrow \mu^- + \pi + N \rightarrow N + e$. The effect of the nonlocalizability of the interaction (with $\lambda = 1.4 \times 10^{-13}$ cm) on the life time of the capture of the μ^- meson is described. The possibility of verifying the calculated effect is discussed. (auth)

6312
SECOND-ORDER PROCESSES IN FERMI INTERACTIONS. P. Budini. Nuovo cimento (9) 10, 1299-1310(1953) Sept. 1. (In Italian)

The scattering of two Fermi particles, as a second-order process of the direct interaction between spinor fields, is studied in the frame of a covariant nonlocal theory. Matrix elements characteristic of short-range and long-range forces are obtained. The distinction is largely independent of the particular choice of the Fourier transform of the form factor and of the nonlocalizability region that determines, in the case of long-range forces, the fine-structure constant of the corresponding long-range interaction. As a numerical example the results are applied to the calculation of the neutrino-electron elastic scattering cross section. (G.Y.)

6313
ON THE QUANTUM THEORY OF FIELDS. Dominique Rivier. Progr. Theoret. Phys. (Japan) 9, 633-61(1953) June.

A quantum theory of fields is presented without any explicit or implicit reference to the canonical formalism. Besides the requirement of invariance under infinitesimal Lorentz transformations and under infinitesimal gauge transformations, another requirement is introduced into the theory; at each step the theory must be independent of the particular set of space-like surfaces chosen in space-time for observing the evolution of the physical systems described by the field variables. Advantages of the method are: (1) the problem of quantization of a given c-number theory can be reduced to that of finding a Lagrangian with an adequate structure; (2) the connection between spin and statistics is brought out as a straightforward consequence of the requirement of invariance under continuous Lorentz transformations; and (3) difficulties linked to the canonical formalism, such as those connected with the existence of identities, disappear. (L.M.T.)

6314
RIGOROUS SOLUTIONS OF MANY-BODY PROBLEMS. K. Wildermuth. Acta Phys. Austriaca 7, 299-310(1953) Oct. (In German)

In order to investigate the efficiency of different approximation methods in the treatment of the 3-body scattering problem, it is meaningful to consider such problems for which rigorous solutions may be obtained. On the basis of different approximation methods a result can be found and compared with the exact solutions, and the value of individual methods for different scattering energies may be estimated. Two examples are studied. In the first case all parts are different from one another and their description is asymmetric. In the second case the parts are similar and exchange effects appear. (tr-auth)

6315
STATISTICS OF VIRTUAL MESONS. Gernot Eder. Acta Phys. Austriaca 7, 278-82(1953) Oct. (In German)

The use of Bose statistics on virtual mesons permits an estimation of higher approximations for the interaction potentials between nucleons. The usual ultraviolet catastrophes do not appear, so that the self-energy contribution remains finite. (tr-auth)

6316
THE INFRARED CATASTROPHES OF QUANTUM ELECTRODYNAMICS. Kurt Baumann. Acta Phys. Austriaca 7, 248-50(1953) Oct. (In German)

A proof applicable to every theoretical perturbation approximation is developed showing that the infrared catastrophes of scattering are compensated by radiation losses of an equal extent in radiationless processes. (tr-auth)

6317
ON THE CONVERGENCE OF THE PERTURBATION METHOD IN THE QUANTUM FIELD THEORY. Ryôyû Utiyama. Progr. Theoret. Phys. (Japan) 9, 593-606(1953) June.

The convergence of the Green functions of one-nucleon and one-meson problems is investigated. In order to get the finite expressions for these Green functions, the vertex function Γ is defined. By virtue of this definition the number of graphs of the proper vertex type of the n-th order in g increases so slowly that the majorant series of the Green function can be made to converge. (auth)

6318
DYNAMIC DESCRIPTION OF SCATTERING BY A POTENTIAL. Juan Manuel Lozano. Rev. mex. fis. 2, 155-79 (1953) July. (In Spanish)

A time-dependent description of the scattering of a wave packet by a short-range nuclear potential is given. It is shown that when the wave packet is initially outside the scatterer, it is possible to introduce an appropriate time-dependent Green function to describe the scattering process.

This Green function is evaluated explicitly in terms of error integral functions, and the only parameters that appear in the Green function are the poles of the S matrix. From the asymptotic behavior of the Green function when $t \to \infty$, restrictions are obtained on the position of the poles of the S matrix which agree with those due to the definition of the S in terms of the derivative matrix R. The present analysis is carried out for arbitrary angular momentum. (auth)

6319

S MATRIX AND CAUSALITY CONDITION. II. NONRELATIVISTIC PARTICLES. N. G. van Kampen. Phys. Rev. 91, 1267-76(1953) Sept. 1. (For Part I cf. NSA 7-2712)

The application of the "causality condition" to the S matrix for nonrelativistic particles encounters several difficulties: (a) there is no maximum velocity; (b) the interference of ingoing and outgoing waves has to be taken into account; (c) wave packets with a sharp front do not exist. The condition is therefore reformulated as follows: at any time the total probability of finding the particle outside the scattering center shall not be greater than 1, for every form of the incident wave packet. From this follows for spherical waves that S, as a function of the momentum p, is analytic and holomorphic in the first quadrant and that $e^{2iap}S(p)$ (where a is the radius of the scattering center) has an imaginary part ≤ 1. That suffices to give an explicit integral representation and a product expansion for S, but these permit a more general form for S than is usually envisaged. If, however, the usual symmetry relation $S(-p) = S(p)^*$ is assumed in addition to the causality condition, more specific equations can be derived, which are direct generalizations of those in Part I. In particular, integral relations between the real and imaginary parts of S and the properties that Wigner found for the R matrix can be deduced. (auth)

TRACER APPLICATIONS

6320

A METHOD FOR DETERMINING DIFFUSION COEFFICIENTS. S. N. Kryukov and A. A. Zhukovitskii [Zhukovitsky]. Translated from Doklady Akad. Nauk S.S.S.R. 90, 579-82(1953). 4p. (NSF-tr-71; D-90-379)

In the method proposed, a layer of a radioactive element is deposited on one side of a thin sample (30 to 100 μ). After diffusion annealing, the radioactivity of both sides of the sample is determined as a function of annealing time. The expression for the dependence of the counting rates I_1 and I_2 of the two sides of the plate on the time t of the diffusion annealing is $\ln \frac{I_1 - I_2}{I_1 + I_2} = \ln K - \frac{\pi^2 D}{l^2} t$, where K is a constant independent of the time and the diffusion coefficient, l the width of the sample, and D the diffusion coefficient. The method was tested on Ag, and agreement with reported values was good. (J.S.R.)

TRITIUM AND TRITIUM COMPOUNDS

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Chicago Univ.

RESEARCH TO ASSAY RAIN AND SURFACE WATER FOR NATURAL TRITIUM CONTENT. QUARTERLY PROGRESS REPORT FOR PERIOD JUNE 1, 1953 THROUGH AUGUST 31, 1953. [W. F. Libby] Sept. 1, 1953. 2p. (NP-4791)

The results of the assay for natural tritium content of rain and surface waters at various locations are tabulated. (For preceding period see NP-4640.) (J.S.R.)